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TURNIP- AND RAPE-SEED PRODUCTION.

POINTS FOR NEW ZEALAND FARMERS.

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THE recent census of stocks of turnip, swede, and rape seed held in New Zealand shows that there will be enough seed to sow approximately 440,000 acres of turnips and swedes, while with regard to rape-seed there will be sufficient for our average season's requirement. It had been hoped that a fair quantity of turnip and swede seed still held in Great Britain would be licensed for export and reach New Zealand in time for the main 1918 sowings. The latest advices, however, indicate that Britain is refusing licenses for any further supplies this season.

Apart from the fact that there will be a shortage over normal requirements, especially with regard to certain varieties, there are in New Zealand a good many lines of turnip and swede seed of distinctly inferior germination that should be sown at a thicker rate than usual. This means that the acreage in turnips and swedes will have to be

less than usual, and increased sowings of autumn forage crops, such as cereals, Western Wolths and Italian rye-grass, will have to be made in the autumn of 1919 to make up any deficiency in this respect. The avoidance of bare stubbles by the inclusion of clovers and temporary grasses along with grain crops will also help to tide over any shortage in the turnip crop. In dairying districts it is probable that the scarcity of turnip-seed will be reflected in an increased acreage of mangels, of which there will be abundance of seed for our 1918 requirements.

On the whole the New Zealand farmer is very fortunate in that the position with regard to turnip- and swede-seed supplies is not far more serious. The only real inconvenience that will be felt will be the very high price (probably in some cases over 7s. 6d. per pound) of certain of our standard varieties. Even with prices as high as they are likely to reach, turnips and swedes will still represent the cheapest forage crops that can be grown.

So far as 1919 requirements are concerned, the position with regard to turnips and swedes may become extremely serious unless special efforts are made by farmers to supplement overseas supplies with locally grown seed. It is quite impossible to forecast whether or not Great Britain will be able to supply anything like our normal requirement of something over 300 tons. It appears fairly certain, however, that many varieties most in demand, such as the Aberdeens, Green Globes, and Red Globes, will be in extremely short supply. Certain English merchants appear fairly confident that they will be able to fill a fair percentage of their 1919 colonial orders provided the necessary licenses are granted by the Home authorities. Others, again, are equally confident that great difficulty will be experienced through an absolute shortage of supplies. The virtual prohibition that has now been established of the export of turnip and swede seed from Great Britain may, of course, be simply a safeguard to ensure a fair carry-over in case their 1918 seed crops are a failure. Satisfactory 1918 crops, therefore, may mean that there would be quite sufficient seed to spare for our requirements. Certain advices from Great Britain, however, indicate that large areas of contract turnips that should have been harvested next August were ploughed under in the spring to make room for food crops of a more direct nature. This seems to point to a short turnip-seed harvest in Great Britain this year, and indicates that unless the New Zealand farmer makes some really serious effort to save a considerable quantity of local seed the position for 1919 may easily be disastrous.

As to local merchants' stocks, there will be absolutely no carry-over for the 1919 season, except perhaps in certain varieties for which the demand is small. It is quite safe to say that such a position has

never before occurred in New Zealand, there being normally a very considerable carry-over from season to season.

LOCAL PRODUCTION.

Up till last season very little turnip-seed had been raised in New Zealand, production being practically confined to the occasional collection of seed from individual bulbs. The question of producing our supplies locally has been suggested on and off for many years past, but the ease and general cheapness with which ample supplies of imported seed could hitherto be procured, the lack of knowledge as to the best methods to adopt, and the scant encouragement given by merchants, rendered any establishment of a local turnip-seed-raising industry almost out of the question. At the present time, however, the great prices ruling for seed, and the willingness of merchants to buy local seed of approved varieties, is a great inducement for farmers to embark on this enterprise.

Apart, however, from the fact that unless during the next summer considerable quantities of turnip-seed are produced locally our pastoral industry may be seriously threatened, the present time affords a unique opportunity of determining whether or not turnip-seed can be classed as a profitable crop to produce. The prices being offered to farmers—namely, 2s. and over per pound—are nearly seven times the price for which turnip-seed is contracted for in Great Britain in normal times. Thus, even with expensive labour and management and small yields, there is a good chance of considerable profit in growing seed, even if it is shown that in normal times the expenses of production are too great to compete against imported seed.

During the past season quite an appreciable quantity of turnip-seed — probably well over 10 tons — has been harvested in New Zealand. The principal crop produced was grown in the vicinity of Ranfurly, in Central Otago. The land had been once cropped out of tussock with Aberdeen turnips, and this was followed by another crop of Aberdeens, broadcasted at the rate of 1 lb. per acre without manure, and sown in the third week of November, 1916. Dry weather delayed germination until well on into January, and, owing to abundance of other feed and the poor nature of the top, feeding-off was delayed till the spring. A great growth of leaves developed in the early spring, but stock refusing to feed at all freely on the crop it was shut up for seed. About the middle of February last the crop was ready to cut, but no suitable binder being available it was harvested by hand, the plants being pulled and the seed flailed out without any stacking. The yield was approximately 8 cwt. per acre, and even then a good deal of seed (estimated at over 1 cwt. per acre) was lost through shaking. The area harvested was between 12 and

13 acres, and birds, although abundant, did not injure the crop. This was by far the most successful turnip crop harvested locally last year, and at the same time it was the largest individual area devoted to seed-production.

In Southland certain areas of Aberdeens and Hardy Green Globe threshed out quite satisfactorily, varying in yield from 2 cwt. to 5 cwt., but many small areas of from ½ acre to 2 acres were complete failures owing to birds. In Canterbury quite a good crop of Imperial Green Globe, yielding 4 cwt. of seed, was also harvested. An experimental area of Hardy Green Globe grown from transplanted bulbs yielded about 2 cwt. per acre, but although a good deal of bird-control was carried out, quite 4 cwt. per acre was destroyed through their ravages. Seed from certain of the crops harvested last summer has been tested for bulb-development and has given excellent results, comparing more than favourably with imported seed. The same can also be said of some trials carried out this year at the Central Development Farm, where locally grown seed was in every way satisfactory when compared with similar varieties of imported seed.

Last year's experience shows that, provided certain of the limiting factors with regard to seed-production are controlled, satisfactory crops of local turnip-seed can be grown.

LIMITING FACTORS OF TURNIP-SEED PRODUCTION.

The main limiting factors in the local production of turnip-seed are three in number—namely, cross-fertilization, grain-feeding birds, and rotting of the bulbs in the field before seeding takes place.

Cross-fertilization.—Any crops that are selected for seed should consist of only one variety, and where more than one variety is saved in the same district the crops should be at least half a mile from each other. If turnip-seed-growing ever becomes a regular practice protection against cross-fertilization of one variety with another will have to be most rigidly carried out. For the production of seed next season, necessitating the immediate reserving of growing crops for that purpose, there is no absolute necessity that only pure crops should be kept for seed. It has been shown that excellent crops may be secured from mixed seed, provided the parents are good-yielding varieties maturing about the same time. Thus, for instance, if sufficient pure crops cannot be reserved, then mixed crops of the following types may be held over for seed (but the yield must be sold as mixed seed, and must on no account be used for the production of any further seed crops) :—

(1.) Green-top Aberdeen with Purple-top Aberdeen.

(2.) Green-top or Purple-top Aberdeen with a good-keeping yellow-fleshed variety, such as Waite's Eclipse.

(3.) Imperial Green Globe with Hardy Green Globe.

(4.) Imperial Green Globe or Hardy Green Globe with Lincolnshire Red.

The Green Globes with Lincoln Red should, however, be avoided in most cases, as the last named is likely to rot before flowering takes place.

It must be clearly understood that I am not advocating the reservation of mixed crops for seed purposes, but recognize that this season it may be difficult to secure enough pure crops of sufficient size and in favourable locations. Thus, for instance, it will be difficult to secure crops of pure Green-top Yellow Aberdeen, but it is quite likely that crops mixed with Purple-top may be available.

Another point to guard against is the close proximity of rape that is being held over for seed. Cross-fertilization of turnip with rape is, of course, fatal, as hybrid turnip-rape is valueless for the production of bulbs. It is, however, with wild turnip that the greatest danger of cross-fertilization occurs, and districts where this weed is extremely prevalent should not be used either for the production of turnip or rape seed. Any turnip crops that are being saved for seed should be gone over in the early summer, and any rape or wild turnip carefully removed. Special attention should also be paid to destroying any of the plants growing in the immediate vicinity of the crops.

Grain-feeding Birds.—The small-bird nuisance is, without doubt, the great limiting factor of the production of turnip-seed of those varieties that keep well through the winter under ordinary field conditions and which would otherwise produce good seed crops. Nearly all the failures recorded last year were due entirely to the ravages of birds, and had the latter been guarded against successful crops would have been produced. The greater part of the damage is done while the pods are quite green. When once they have commenced to turn colour there is not so much danger, and when quite ripe the seeds are rarely eaten out of the pod. The critical period extends about three weeks, from the middle of December to the first week in January. The exact period, of course, may vary with different varieties flowering at different dates.

It has been conclusively shown that the larger the individual area the less likelihood there is of extensive bird-damage occurring. Thus, all the crops, with one exception, reserved for seed last season, consisting of from ½ acre to 2 acres, were completely ruined by birds, but in all cases the larger the individual area the greater was the yield per acre. This is a most important point, and shows how necessary it is to have a small number of large individual areas rather than a large number of small ones. In order to be fairly safe from birds, crops should not be smaller than 15 acres. Unless specially

sown for seed purposes, it will be difficult for any farmer to reserve such a large acreage, and this season it may be necessary to attempt seed-saving on much smaller blocks. At any rate, unless the farmer is certain that he can protect the crop efficiently, it is quite useless reserving just an acre or so for seed purposes. In selecting areas to be held over for seed special attention to the bird question should be given in every case. Crops near plantations or in fields surrounded by high live fences should never be reserved. In one instance last season a 4-acre block bordered by a large pine plantation was completely ruined after it had given promise of yielding well over 6 cwt. of seed per acre.

With the aid of scarecrows, automatic bird-scarers, and shooting (especially during the early hours of the morning) the ravages of the small bird can be kept down fairly well. Such methods are imperative with regard to all small areas of under 10 acres, and though expensive they will be found to be quite payable. In the early days of rape-seed production in New Zealand the small-bird nuisance was as marked as it now is with regard to turnip-growing. As soon, however, as large areas of rape-seed began to be saved the effects of birds rapidly diminished, and there is no reason to assume that the same would not occur with turnips grown for seed in large individual blocks.

Rotting of Bulbs in the Field.—The destruction of crops through rot before the seed crop is produced is a limiting factor only with regard to swedes and early-maturing varieties of turnips, and the system of holding over ordinary feeding-off crops for seed purposes is not possible with regard to such varieties. This brings us to the point of deciding what kind of turnips should be saved for seed purposes. The answer, of course, is only those varieties that will carry through to the spring without rotting. In certain districts, however, one particular turnip may keep well, while in another district it readily rots away after attaining maturity. So far as late years' experience is concerned it has been shown that the Aberdeens, both Green-top and Purple-top, together with some of the improved varieties, such as Perfection and Favourite, are admirably adapted for holding over for seed purposes. Imperial Green Globe and Hardy Green Globe are also quite satisfactory. It will be well, therefore, to restrict seed-saving very largely to these varieties. Apart from their being satisfactory for the purposes they represent, they are the turnips that are most extensively grown, and at the same time the very varieties of which short supplies of seed are to be expected. Of course, if the farmer has good crops of such varieties as Fosterton Hybrid, Romney Marsh, or similar good-keeping yellow-fleshed varieties available, their reservation for seed would be a good policy.

METHODS FOR SECURING SUPPLIES.

The following are the main methods that could be adopted for securing supplies of locally grown turnip-seed:—

(1.) By the farmer himself reserving certain areas of the present growing crops, and selling the seed next year on the open market.

(2.) By the seed-merchant contracting at the present time for the seed from a definite crop at a certain price per pound.

(3.) By the seed-merchant buying from the farmer growing crops at the market price, and paying reasonable expenses of management, harvesting, and threshing, together with the rent of the land during the time the land is occupied.

Assuming a shortage of turnip-seed next year, the first method would be by far the most profitable for the farmer to adopt. He, however, will probably not undertake any seed-growing unless a definite price for the seed is guaranteed him. This many seed-merchants are prepared to do at the present time, and are offering in the vicinity of 2s. per pound for seed harvested next summer from approved crops. The third method, that of merchants buying crops outright, is also being adopted, but is not entirely satisfactory, as the farmer having no further interest in the crop is not likely to exercise the same degree of supervision as when he is to receive a definite price for the seed produced.

It is to be hoped that from 600 to 1,000 acres of turnips may be reserved for seed this year. Many merchants are quite willing to contract for large acreages, and it is entirely in the farmers' hands whether or not the production of turnip-seed will be carried out on an extended scale. It is possible that shortage of labour will act as a deterrent, but the amount required would not be very great, although it would be mainly needed just at the period when the ordinary harvesting operations are in full swing. Labour for bird-control, especially if small areas are reserved, would also be heavy; but as the critical period coincides with the school summer holidays juvenile labour might well be utilized for this purpose.

There are a good many difficulties to be overcome in the matter of harvesting turnip-seed, more especially in the way of avoiding shaking off the seed in the various operations between cutting and threshing. Full inquiries as to the best methods of procedure are being carried out, and the results will be published in the *Journal* in time for next season's harvest.

SWEDE-SEED PRODUCTION.

Swede-seed production has not, so far as I am aware, ever been successfully carried out on an extended scale in New Zealand. From

time to time small quantities from individual transplanted bulbs have been secured, but wherever swedes have been tried as a seed crop on a field scale failures have resulted. This in every case has been due to the rotting of the bulbs by the "dry-rot" fungus (*Phoma napo-brassicae*). All the efforts to save swede-seed on an extended scale have been confined to the southern portion of the South Island, where phoma is especially prevalent. Provided the crops were grown in districts more or less free from phoma there is no reason why swede-seed-raising should offer any greater difficulties than those experienced with the yellow-fleshed and late-keeping varieties of the white-fleshed turnips. The great trouble, however, is that it is impossible definitely to locate districts sufficiently free from phoma so as to render seed-production feasible when carried out in the same way as has been adopted with turnips. Phoma is extremely widespread, and is likely to cause extensive rotting even at a period later than when swedes are normally fed off. Thus a crop apparently quite clean at the end of August may almost completely rot away before the end of September.

Farmers who have never experienced phoma in their swede crops even when held into the early spring will be well advised to reserve certain areas for seed-production. The price of swede-seed is certain to be extremely high. Moreover, European supplies are likely to be inadequate for our 1919 requirements, and if such should turn out to be the case swedes will have to be largely replaced by the better-keeping varieties of yellow-fleshed turnips, such as the Aberdeens, until such time as full supplies of swede-seed are again available. Apart from the fact that in many districts Aberdeens are not very suitable for replacing swedes, the seed of these turnips is also likely to be short. It is therefore to be hoped that some effort for the saving of local swede-seed will be made, although the prospects are by no means as good as is the case with the yellow-fleshed and Green Globe type of turnips.

In Europe two methods of swede-seed raising are in vogue. In the first selected bulbs are transplanted in the early winter and covered with soil right up to the necks, leaving only the tops exposed. In this way phoma infection, normally occurring on the exposed portions of the bulb, is avoided. The second method is to sow very thickly (using 4 lb. to 8 lb. of seed per acre) in the late summer. In this way bulbing is almost entirely avoided, and very successful seed crops may be produced.

The first method—that of deep planting—could be adopted in New Zealand this winter, and seed available for 1919 sowing produced. The labour and expense involved, however, would be very considerable. Again, the bird factor would be even greater than with turnips, as the individual areas would probably be small. When these considerations

are taken into account it is not likely that many farmers would be tempted to carry out the enterprise.

The second method cannot now be adopted for the production of seed for 1919 requirements. If sown, say, next February, or even later, on stubble land, in either 7 in. or 14 in. drills, at the rate of from 4 lb. to 8 lb. of seed per acre, supplies of local seed could be secured for 1920 sowing.

EARLY-MATURING TURNIPS.

Seed-sowing of early-maturing turnips, such as Purple-top Mammoth, Devon Greystone, White Stone, and Lincoln Red, cannot be successfully accomplished with any degree of certainty by holding over ordinary crops sown for feeding purposes. In most cases one or other of the soft-rotting bacteria causes the destruction of the crop prior to seeding. In order to produce satisfactorily seed of such varieties it would be necessary to adopt the method of thick late summer sowing, as mentioned for swedes. This is the regular European method adopted for the production of soft-turnip seed. So far as 1919 requirements are concerned, no local provision can now be made except in the most northern parts of New Zealand, where thick winter sowing might result in seed crops being harvested next summer.

Personally, however, I do not consider that a seed shortage in certain of our most rapidly maturing turnips would be very serious provided there was abundance of one or other of the Green Globes available. In certain dairying districts rapid-maturing turnips are at present looked upon as a necessity, but their place can be taken, temporarily at any rate, by one or other of the summer forages. A shortage of Lincoln Red would be severely felt in parts of the South Island, but there are certain districts in Southland where crops of that variety might be successfully held over for seed. It is doubtful, however, if there are any crops available, as the feeding-off of the variety is normally completed at the present time. If any mid-winter sowings for seed-production are attempted in the warmer parts of the North, I should strongly advise the use of this variety, or its very close relative Red Paragon. The seed should be sown in 14 in. drills at the rate of from 4 lb. to 6 lb. per acre.

SEED-SAVING IN SMALL QUANTITIES.

Apart from the immediate reservation of large areas of turnips for seed-production next summer, it would appear to be a wise policy for many farmers to endeavour to save sufficient seed for their own particular requirements. Personally I am not in favour of such a system becoming a regular and permanent feature, inasmuch as variety deterioration is likely to occur unless the work is carried out carefully

and systematically. On the other hand, in order to tide over any temporary scarcity that may be experienced, turnip- and even swede-seed-saving on a small scale by individual farmers during next summer should be carried out. The best method to adopt would be to transplant bulbs any time before the end of July. Well-shaped bulbs weighing from 6 lb. to 8 lb. should be selected, and planted in rows about 2 ft. apart, spaced about 9 in. to 1 ft. apart in the rows. In the case of turnips the bulbs should be planted fairly deep, leaving only a couple of inches or so of the bulb above the surface of the ground. With swedes, they should be covered with soil right up to the neck, so as to avoid destruction by the dry-rot fungus. Quite a small area in the garden would be sufficient for most farmers who do not ordinarily sow out large acreages. One ounce of seed per bulb when grown under these conditions can be looked upon as an average yield, so that from twelve to sixteen bulbs should supply enough seed to sow an acre.

Care should be taken for each farmer to save only a single variety of turnip or swede. In districts where, say, a variety of a swede, an Aberdeen and a Green Globe, are the main varieties required, one farmer might grow enough of one particular variety for himself and two or three neighbours, and they in turn could grow sufficient of the other varieties for their combined needs. With a certain amount of co-operation along these lines there should be no difficulty in securing considerable quantities of seed. Special attention should be paid to the destruction of any wild turnip in the vicinity of these garden plots, as otherwise any seed produced might be quite valueless.

As already indicated, small birds, unless controlled, are very liable to completely spoil the seed crop of very small areas of turnips such as are suggested here, but in many cases the plots might be netted in, and thus any loss in this connection avoided. If netting-in is not feasible the measures previously detailed should prove fairly effective. Harvesting should be delayed until the seed is quite ripe and easily threshed out with a flail. The stems may be either cut with a sharp sickle or pulled by hand, and the seed should be immediately flailed out. It should then be dried in the sun for a day or two, as otherwise sweating is likely to occur and moulds to develop, often completely spoiling the germinating - quality. Damage in this direction is, however, not likely in lots of only a few pounds, and has mainly to be guarded against when threshing out large areas direct from the stook. During the past season a line of nearly eighty sacks of rape-seed was completely ruined through being bagged before properly dried.

The main varieties of turnips that should be saved for seed are those advocated for more extended crops—namely, the Aberdeens and the Green Globes. As regards swedes, the variety selected should be the one that is most extensively grown in the district where the

seed is being saved, but one cannot go far wrong with either Superlative or Magnum Bonum. Champion is also an excellent variety, at present largely overshadowed by many of the newer varieties, but it has a very good reputation as a large and reliable seed-bearer.

RAPE-SEED PRODUCTION.

For many years past it has been well known that excellent crops of rape-seed could be produced in New Zealand from crops used for ordinary forage purposes, and then allowed to seed approximately twelve months after sowing. Until quite recently, however, there was an intense prejudice against locally grown seed, and few seed-merchants were prepared to operate in local seed of this description. There was a general impression that reliable rape-seed could be secured only from crops specifically grown for seed, and that feeding-off resulted in the production of seed yielding inferior crops. This idea was largely based on the fact that feeding-off is rarely practised in the production of European rape-seed. Again, from time to time local rape crops that were in themselves of an unsatisfactory type were saved for seed, and this led to a feeling of great uncertainty as to local seed producing as good crops as those secured from imported seed. During the past four years, however, the scarcity of imported rape has led to merchants operating freely in locally produced seed. The excellent forage crops that have been produced from local rape-seed, and its general reliability, provided the seed is procured from crops derived from a high-grade type of seed, makes it clear that in future all our requisite supplies can be profitably and satisfactorily secured from locally grown crops.

It is difficult to determine accurately the quantity of rape-seed used annually in New Zealand, as, apart from the variation in the area under rape, the agricultural statistics are not wholly reliable, inasmuch as some of the rape used in the laying-down of grass on ploughed land is not enumerated. Again, that used in bush-burn mixtures and a certain amount used in stubble-sowing can be only estimated. The following, however, can be looked upon as a fairly reliable estimate of the quantity annually used :—

	Acres.	Tons.
Rape for feeding off	220,000 at 4 lb. per acre, about	400
Rape and grass not enumerated in agricultural statistics	70,000 at 2 lb. per acre, about	65
Rape used in bush-burn mixtures, &c. ..	200,000 at ½ lb. per acre, about	50
Total		515

NOTE.—A good deal of the area "Rape for feeding off" consists of rape and grass.

In addition to this, in seasons when conditions are unfavourable a large amount of resowing has to take place, so that probably 550

tons per annum is not an excessive estimate for covering all requirements. Another point that should be considered is the quantity of rape-seed used in Australia, estimated at the present time at 120 tons per annum. It would appear that New Zealand might well fill this demand; in fact, during the past season a very considerable quantity of seed has been exported to the Commonwealth.

From the foregoing it can be seen that an annual production of from 550 to 650 tons of rape-seed could be easily absorbed. There seems no reason why locally produced seed should not provide the whole of our requirements. If this were done a permanent and extremely profitable sale-crop would thus be added to our minor agricultural industries.

Limiting Factors. The three main limiting factors in the successful development of rape-seed-growing as a permanent industry are over-production, depredation by small birds, and cross-fertilization by wild turnip, the latter being one of the most serious troubles.

So far as overproduction is concerned, this can be avoided by farmers growing only on contract for seed-merchants. In this way a regular price could be maintained and the danger of glutting the market obviated. Such a system is general in Great Britain, where the majority of the rape for seed-houses is grown on contract at prices varying from 9s. to 14s. per bushel. The small-bird pest was in the early history of local rape-seed production just as serious a factor as it now appears for the production of turnip-seed. It has, however, been conclusively shown that the larger the individual crop the smaller the damage sustained. In crops of over 20 acres, in fact, the small-bird factor can be looked upon as trifling compared with where the crop consists of a few acres only.

A Profitable Sale-crop.—The yields of rape-seed are in general very good, and from 8 cwt. to 10 cwt. per acre can be looked upon as a satisfactory crop. As rape-seed crops in New Zealand are always treated as ordinary feeding-off crops, it can be seen that the expenses of seed-production are virtually limited to rent and harvesting-charges. In all cases the whole costs of production are more than covered by the grazing-returns, so that rape-seed production can be looked upon as extremely profitable even when the price realized is low. At 2d. a pound, at which figure it would always successfully compete in price against imported rape of even the lowest grades, a 10-cwt. crop of rape-seed would equal in gross receipts a 40-bushel crop of wheat at 5s.

Considering the low cost of production of rape-seed under the New Zealand system the profitable nature of the crop can be easily realized. Provided the seed produced is maintained at a high standard of quality, there is no doubt that rape-seed will become a

regular crop in the Dominion. The excellent prices and keen demand that has now been created for local seed makes it certain that sufficient local seed will be produced next season to obviate any shortage that might otherwise have occurred through difficulty of securing imported seed.

THE NEED FOR CROP-SUPERVISION.

In the growing for seed of named varieties or strains of agricultural crops, such as turnips and rape, a guarantee that the crop grown is true to name and has been produced under conditions resulting in the production of reliable seed is essential. If the growing of various strains of Brassica is to become permanent in New Zealand, then some proper system of crop-control will be imperative. This will be especially true of turnip-seed production, but we need not discuss at the present time this matter with regard to that crop. Personally, I am not particularly sanguine as to turnip-seed becoming a regular crop in New Zealand in normal times. The long time taken by the crop to develop, and the lack of any other receipts from it except those derived from the seed, will always be a considerable drawback, although at the present time it is not of any consequence owing to the very high value of the seed.

As regards rape, provided due crop-supervision is carried out, I feel assured that it will become one of our regular minor agricultural industries. It is hardly likely ever to assume large dimensions. The profitable returns that can be secured and the comparatively limited amount of labour required ensure, to my mind, an average annual acreage of something over 2,000 acres, which would supply all local and Australian requirements for some time to come. At the present time merchants purchasing local rape-seed require to be satisfied that the crops have been grown from seed of an approved strain, and that the crop was free from wild turnip. Such precautionary measures are very necessary, but cannot always be satisfactorily carried out by the merchant. It appears to me that if rape-seed-growing is to be put on a permanently satisfactory footing a system of official crop-inspection—say, at the time of the first feeding-off and again just before the plants begin to flower—is necessary. Under such a system the tendency to save seed from inferior strains or in districts where cross-fertilization with wild turnip occurred would be largely stopped. So far as local rape-seed is concerned, it would be of no value that the greater part of the seed was reliable. If only a small fraction produced unreliable crops, then the industry would be ruined. It is simply the fact that at times the seed produced unreliable crops that has caused imported open-market rape and turnip seed to be almost entirely replaced by "supervised" seed grown by British seed-merchants under a crop-control system.

THE POISONOUS AND SUSPECTED PLANTS OF NEW ZEALAND.

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INTRODUCTION.

THE yearly loss of stock from the effects of poisonous plants in any new pastoral country into which exotic herbivoræ are introduced is often enormous. Chesnut and Wilcox (1900) recorded over ten thousand cases of poisoning of sheep, cattle, and horses in Montana, U.S.A., in one season. Various species of poisonous plants were responsible for this loss, which in the case of the sheep consisted of a fatality of 33 per cent. of those affected, in the cattle 66 per cent., and in the horses only 4 per cent. Dr. Lauder Lindsay visited New Zealand in 1861–62, and was struck with the devastation in the flocks and herds of the settlers by tutu (*Coriaria* sp.), and states that a farmer was fortunate if he lost only 25 per cent., and that the losses might be as high as 75 per cent. of his stock. Making all allowances for the colonial's desire to provide a "new chum" with welcome material for a traveller's tale, there is no doubt that in the early days of the settlement the losses from this cause alone were in the aggregate very large. Now, owing to the knowledge of the poisonous nature of tutu possessed by all herdsmen and drovers, very great care is exercised, especially with travelling stock, with the result that the preventable loss is small. What is now desired is that a similar knowledge and care should be exercised with regard to other poisonous plants, such as the waoriki, ngaio, strathmore weed (*Pimelia* sp.), rangiora, karaka, and many other native and introduced poisonous plants, the action of which and conditions under which they may be poisonous are less known than that of the tutu.

In the following pages it is hoped to shed some light on a subject often darkened by testimony apparently conflicting, but which sometimes may be made clear by a study of the history of each case.

RANUNCULACEAE.

All the species of this family must be suspected, owing to the close relationship which one member exhibits towards another, and their similarity of physiological and chemical characters. The genera which occur in New Zealand are *Clematis*, *Myosurus*, *Ranunculus*, and *Caltha*.

Species of *Clematis* in Europe, notably *C. flammula*, produce inflammation (hence the specific name) and blistering of the skin, and when bruised in a mortar give off volatile matters which irritate the eyes and throat. The activity of this plant is greatly diminished by drying. *Myosurus* and *Caltha* are two comparatively rare genera in this country, but species of *Clematis* and *Ranunculus* are abundant. The European *Caltha palustris* L., the marsh-marigold or king-cup of England, is poisonous. No instances of stock having been poisoned by the New Zealand species of *Clematis* or *Caltha* have come under the writer's notice, but *Ranunculus* has furnished many instances in which one or other of the native or introduced species has been strongly suspected of poisoning stock. *Ranunculus rivularis* Banks and Sol., the waoriki of the Maori, is a small yellow-flowered buttercup with a deeply divided leaf, so abundant in some swamps and forming such a mat of herbage that it would be difficult for stock, especially cattle or horses, to avoid eating the plant when driven by hunger and the drying-up of the adjoining hill pasture in summer to forage in the lower-lying swampy areas.

Waoriki is said to have been responsible for the death of many colts in the Rotorua district before the source of the trouble was discovered. In June, 1913, a most remarkable and mysterious case of poisoning came under the notice of the Department. Some cattle died in a slaughterhouse-yard near Wellington under circumstances which pointed strongly to poison as the cause, and what was more unusual was the statement that cattle had been dying there in a similar way for the past thirty years. The Government Veterinarian who made a post-mortem examination of four beasts found inflammation of the mucus membrane of the fourth stomach, small intestines, and cæcum—in his opinion, insufficient to cause death. In one case there was well-defined ulceration on the mucus membrane of the fourth stomach in appearance similar to an ulcer produced by corrosive sublimate. From the first onset of symptoms the animals had shown signs of intense pain, and died within two hours or sooner. Mr. Clayton, who examined the specimens which arrived at the laboratory, described the abomasum as showing a great many petechial (purplish) spots, especially towards the duodenal end. The contents of the rumen were alkaline, but the fourth stomach acid. Evidently the poison acted chiefly on the fourth stomach.

In December the same year another case happened in which two Hereford cows died under similar conditions in another Wellington slaughterhouse-yard four days after their arrival in the yards. Mr. Clayton made a post-mortem on one cow, an aged Hereford in good condition, which had apparently died without struggling in the early morning. All the organs were healthy with the exception of the abomasum, which showed signs of gastritis. This was more marked

towards the duodenal end, and there was an inflammatory patch in the duodenum about a foot along its course. The Veterinarian was of opinion that the animal died from some gastro-intestinal irritant. In the specimens taken from the beast the writer could detect no mineral poison, but found a large quantity of seeds of a species of *Ranunculus*, identified by the Biologist (Mr. Cockayne) as *R. repens*. The writer estimated that the stomach-contents contained about 1,400 of these seeds (about 1 gram weight), which he considers extremely significant in view of the definite statements by several authorities concerning the poisonous properties of this and other European species of *Ranunculus*. Attempts, however, to obtain direct evidence of the poisonous nature of *Ranunculus repens* by feeding a five-months-old calf at the Wallaceville Laboratory farm with the fresh plant failed, although over 5 lb. weight of the plant was consumed. A feeding experiment with a guinea-pig also gave a negative result. It might be urged that in the case of the abattoirs stock it was the seeds and not the vegetative portion which were the toxic part of the plant. Two other cases not investigated by the writer, which may be waoriki poisoning, are mentioned in the *Journal*, vol. vi, p. 559, 1913, and in the Department's Annual Report for 1909, p. 181.

It will be noticed that it is usually the larger animals—cattle and horses—which are alleged to be affected by *Ranunculus*. Possibly the cleaner-feeding sheep are able to avoid eating the buttercup-plants, and also are not driven to seek food in the swamps in summer as in the other cases. The following case in which the animals may have been starved into eating *Ranunculus* is an instance of sheep being the victims. In the Dannevirke district, in February last, Mr. Meade, Government Veterinarian, reported that on 22nd January 2,500 ewes were driven into a 5-acre paddock for a few days and then returned to the hills. This paddock contained "fescue affected with ergot and much buttercup and large daisy." Since 2nd February seventy ewes had died. No mineral poison could be detected in the specimens sent.

Baber, 1886, "Medicinal Properties of New Zealand Plants" (Trans. N.Z. Inst., vol. 19, p. 321), states that waoriki is poisonous to sheep. Goldie, 1904, "Maori Medical Lore" (Trans. N.Z. Inst. vol. 37, p. 113), says that the expressed juice of *Ranunculus rivularis*, which has blistering properties, is used for rheumatic and other painful joint-diseases, and that the leaves of species of *Clematis* are used to produce blisters (counter-irritation).* Cheeseman, 1906, "Manual of the New Zealand

*Mr. Elsdon Best points out that the Maori knowledge of medicinal plants is necessarily of the post-pakeha period. The old-time Maori considered that his ailments were the punishment of the gods for his misdeeds, and his fatalist nature would not allow of any appeal to medicine to ease his pain or ward off death.

Flora" (p. 25), states that stockowners consider it to be highly poisonous and attribute to it many deaths occurring among cattle in swamps in dry summers. Long, 1917, "Plants Poisonous to Live-stock" (p. 10), states that a number of species of *Ranunculus* are acrid, irritant, and severely poisonous. There are variations in the poisonous character according to the season, and some parts of the plant are more toxic than others. At the time the young shoots are developing but little of the poisonous principle is present, and some (*e.g.*, *R. ficaria*) are not then poisonous, but a larger quantity of the poisonous principle forms later, and some species are especially dangerous at the time of flowering, after which the toxicity decreases with the maturity and state of dryness of the plant. The flowers are the most poisonous, and after them the leaves and stems. The toxic principle is volatile, and buttercups are easily rendered innocuous by drying or by boiling, so much so that when made into hay they may be regarded as a nourishing food and are readily eaten. Indeed, *Ranunculus repens* is scarcely at all injurious even when green, though a fatal case of poisoning of sheep said to be due to this species is reported in *The Veterinarian* in 1844. Fresh *R. aquatilis* (common in some New Zealand creeks) is held to be quite harmless, and has been used in Europe for stock-food.

Feeding experiments have been carried out with a small quantity of the dried *Ranunculus rivularis*, but no injurious effect was produced, probably owing to the principle having disappeared on drying. From the above it will be recognized that there is much to be done in experimenting with this and other species in New Zealand. The conditions under which stock are poisoned by *Ranunculus* require to be more definitely known. Probably the season of the year, the age and condition of the plant, the portion of the plant consumed, and the condition and species of the animal which consumed the plant all play their part in contributing towards the result.

MAGNOLIACEAE.

The family Magnoliaceae contains the genus *Drimys*, a species of which (*D. Winteri*) furnishes the medicinal Winter's bark of commerce. *Drimys axillaris* and *D. colorata* are the two common New Zealand shrubs known as horopito, or pepper-tree, for the leaves have a burning taste. Only one alleged instance of poisoning has come under the author's notice: an Okoroire settler, in May, 1910, having lost some cattle, found the inside of one gorged with horopito-leaves. Two writers—Colenso, 1868, Essay (Trans. N.Z. Inst, vol. 1, p. 52), and Stewart, 1886 (Trans. N.Z. Inst., vol. 19, p. 603), have suggested that the New Zealand species is likely to have medicinal value.

VIOLARIEAE.

This is a family which contains a number of shrubs of the genus *Melicytus*, a species of which, *M. ramiflorus* Forst., the mahoe or hinahina of the Maori, and the cow-tree of the settler, has sometimes been suspected of causing the death of cattle. They are extremely fond of the leaves, and voraciously browse on the branches, which the settlers sometimes cut down for stock in times of scarcity. A veterinarian has suggested that possibly the small branches ingested with the leaves may cause digestive trouble and even death. Apart from this phase there is no evidence of the plant being injurious.

MELIACEAE.

Meliaceae contains the well-known *Dysoxylum spectabile* Hook. f., the kohekohe of the Maori, the New Zealand cedar, or mahogany as it will probably be called when its timber is more generally known and appreciated. The handsome glossy light-green leaves are pleasantly but intensely bitter to the taste, and have been used for bittering beer. A curious fact which the author has noticed is that this bitter principle is not soluble in water, and that if a decoction in cold water is made of the leaves and the solution filtered the filtrate is not bitter. Further, an appreciable time has to elapse before the chewed leaf becomes bitter in the mouth. Hence the bitter principle is probably formed by the action of the saliva on some other body present in the leaf. No information is available as to the physiological action of the plant, but some species in the Dutch East Indies are said to contain "toxic acids" (Jour. Soc. Chem., Ind., 31/3/00). Goldie states that the leaves and bark are used by the Maori as a bitter tonic and stomachic. A decoction has also been used to allay coughing and to arrest lacteal secretion.

(To be continued.)

Paspalum in Australia.—The *Farmer and Settler* (Sydney) states: Farmers in some parts of Illawarra are much concerned at the great spread of paspalum this season, and have expressed the fear that it might take possession of cultivation paddocks, and might even become a pest. Others, however, welcome its advent, as they find it a great milk and butter producer when kept eaten down. At Gerringong mowing-machines are run over the paddocks when it attains a fair height, and by this method there is always a good growth of succulent grass. So prolific has been the growth on the Terragong Swamp that cattle are almost lost to view. Some farmers state that it is a fine weed-destroyer when once it takes possession. Altogether the verdict seems to be in favour of the grass, which promises to become one of the staple grasses in the Illawarra.

HINTS ON CONTAGIOUS ABORTION IN CATTLE.

A. R. YOUNG, M.R.C.V.S., Veterinary Supervisor.

WHEN contagious abortion is present in a herd it is necessary to adopt a sound system of treatment.

The bulls should be washed out once a week during the period they are in use. The method to be adopted, after first removing the tuft of hair attached to the sheath, is that recommended in the Department's Bulletin No. 20 ("Contagious Abortion and Failure of Conception in Dairy Cows"). The under-parts of the body likely to come in contact with the cow's vulva should at the same time be sponged with the same solution.

Irrespective of abortion, every dairy cow should, by the use of horse-clippers, have all the hair removed from the tail except the brush, also removed from the escutcheon right up to and around the root of the tail. This greatly facilitates cleanliness at all times and reduces the possibility of infection.

When a cow calves, whether she has had abortion or not and whether she has cleansed properly or not, she should be at once washed out with at least a gallon of water which has been boiled and allowed to cool to blood-heat, and to which has been added 4 oz. of soap. No other disinfectant is to be used with this.

For a healthy cow which has cleansed properly and has not aborted this one wash will be sufficient, but at the same time the tail and other back parts should be washed with soapy water. This treatment removes from the womb all liquid resulting from calving-conditions which, when it is allowed to remain, constitutes a grave danger to the general health of the animal and often leads to subacute blood-poisoning, evidence of which is seen in the animal not thriving after calving. This precautionary measure has been adopted for some years past upon several farms in New Zealand with marked success.

For an animal which has aborted, or one retaining the afterbirth, the above treatment should be adopted for the first two days. After this the instructions contained in the bulletin upon the subject should be followed.

It is fully understood that there is a great difficulty, especially under present war conditions, in carrying out minute details of this

sort, but it is only by doing so that the disease can be stamped out. For instance, it is no use washing out a cow and leaving the discharged material for other animals to become contaminated with, yet this point is rarely considered by farmers.

I may mention that upon some of the large ranches in other countries, where it is impracticable to carry out treatment, a certain amount of success is being attained by adopting an alternative system. No animals are sold which have ever aborted, and no fresh cows are ever put upon the ranch, the only cows used being those bred upon the place. The same procedure is adopted in regard to the bulls, unless absolutely compelled to procure new blood. The object of this is to bring about immunity in a herd bred from animals which have become immune to the disease. Several large ranch-holders who have acted upon this principle claim that it has been a great success, and such cases are mentioned in official reports.

The immunity principle should not be lost sight of by the stock-owner in this country, because recent investigations have conclusively proved that the germs causing contagious abortion may invade other parts of the cow's body besides the genital tract. It has been found in the udder and other parts, but not to the same extent as in its natural habitat; still, this may account for some failures in our present system. This could be fairly met by the use of preventive serum in conjunction with other precautions, and the Department is devoting attention to this development.

"FAIRY RINGS" ON LAWNS.

SULPHATE-OF-IRON solution will in most cases kill out "fairy rings," provided the whole of the ground through which the mycelium of the fungus is present is thoroughly permeated. In many cases, however, the fungus so thoroughly waterproofs the ground that the solution does not penetrate, and is of no use. Good results have been secured by thoroughly forking over the ground before applying the sulphate of iron, but in the case of lawns where the surface is very hard this is very difficult. In certain cases excellent results have followed digging up lawns—without any soil-removal—and giving several applications of iron sulphate while the ground is soft and permeable to the solution. After such treatment seeding follows. The great objection to this practice is that, the whole of the lawn having to be treated, both cost and labour are great. When treating the soil in this manner the strength of the sulphate should be 1 lb. to 2 gallons of water. In certain cases good results have followed the digging-in of crushed iron sulphate at the rate of 5 cwt. per acre, but in general better results follow the dissolving of the material in water.—*A. H. Cockayne, Biologist.*

POULTRY-FEEDING TESTS AT MILTON.

HEAVY BREEDS FED WITHOUT WHEAT OR POLLARD.

In May, 1915, yearly feeding-tests were instituted at the Department's Milton Poultry-station with the object of ascertaining what results could be obtained from pullets by eliminating wheat from the ration. The tests were continued with the same birds during the following twelvemonth (1916–17), with slightly altered rations, this mainly with the object of determining the value of lucerne-meal when used as a substitute for pollard. It will be recalled that two pens of White Leghorns and two pens of Brown Leghorns took part. It was considered that by using one pen of each breed of the same age and strain, and providing a different diet respectively, the results would be more conclusive than would have been the case if single pens only of one breed were used. The results in eggs produced in these tests have clearly demonstrated that wheat and pollard are not indispensable in the ration of the heavy layer when oats, maize, and lucerne chaff or meal are substituted. In the first year's test the wheat-fed birds (pen No. 1, White Leghorns, and pen No. 2, Brown Leghorns) laid 1,438 and 1,463 eggs respectively, an average of 239 and 243 eggs per bird for the year; whereas the non-wheat-fed birds (pen No. 3, White Leghorns, and pen No. 4, Brown Leghorns) produced 1,433 and 1,449 eggs respectively, an average of 238 and 241. In the second year pen No. 1 with the same ration as previously supplied, including both pollard and wheat, laid 956 eggs, an average of 159 per bird; while pen No. 2, without wheat or pollard, produced 1,079 eggs, an average of 179 each. Pen No. 3, on the same ration as pen No. 1, laid 1,042 eggs, an average per bird of 175; pen No. 4, without wheat or pollard, yielded 1,211 eggs, an average of 201 eggs each.

THE HEAVY-BREEDS TEST.

During the twelvemonth 1st May, 1917, to 30th April, 1918, further tests on similar lines have been carried out, but with the heavier breeds. In this period two pens of Black Orpingtons and two pens of White Plymouth Rocks were tested (six pullets in each pen), one pen of each breed having wheat and pollard in the ration, while the others had none. The birds were of the same age and strains, and were selected as uniformly as possible on breed-type points indicating constitutional vigour and laying-power. As will be seen

by the accompanying table, the pens having no wheat or pollard produced a substantially larger number of eggs than the others; also that the profit over cost of food is in favour of the no-wheat pens.

It may be mentioned that the birds which took part in the test were typical specimens of the general-purpose breeds they represented. They were well up in standard requirements, particularly in regard to weight. At the same time they possessed the necessary refinement which is imperative in the make-up of an ideal utility bird. In no way did the birds resemble many of the so-called laying-strains of Black Orpington and White Plymouth Rock to be seen throughout the Dominion to-day, the latter approaching more to the Leghorn type than to that of the Black Orpington and White Plymouth Rock. Probably had smaller and more alert birds been selected a higher egg-yield would have been obtained. This, however, was not the object of the test. The primary aim was to discover as far as possible what results in egg-yield could be obtained from high-class dual-purpose breeds with wheat and pollard eliminated from the ration. The number of eggs produced is certainly not exceptional.

POULTRY-FEEDING TESTS AT MILTON POULTRY-STATION.

THIRD SERIES—HEAVY BREEDS. PERIOD 1ST MAY, 1917, TO 30TH APRIL, 1918.

No. of Pen, and Breed.	Number of Eggs produced.	Average Number of Eggs per Bird.	Value of Eggs.	Average Value of Eggs per Bird.	Food consumed.		Cost of Food.	Profit over Cost of Food.	Cost of Feeding per Bird.	Profit per Bird over Cost of Food.
			£ s. d.	£ s. d.		lb.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(1.) 6 Black Orpingtons ..	1,204	200	8 2 6½	1 7 1	Pollard	302	5 2 0	11 2 0	0 8 6	0 18 7
(2.) 6 White Rocks ..	1,192	198	8 1 5½	1 6 11	Bran	92				0 18 5
					Maize-meal	120				
					Meat-and-bone meal ..	33				
					Mash	45				
			16 4 0		Meat-and-bone meal (fed separately)					
					Wheat	414				
					Lucerne-meal ..	250				
					Bran	90				
(3.) 6 Black Orpingtons ..	1,260	210	8 10 5½	1 8 5	Maize-meal	100	5 5 9	12 0 2	0 8 10	0 19 7
(4.) 6 White Rocks ..	1,301	216	8 15 5½	1 9 3	Crushed oats	120				1 0 5
					Meat-meal	34				
					Meat-meal (fed separately)	50				
			17 5 11		Whole oats	440				

The fact, however, that the birds possessed exceptional table qualities and at the same time produced a year's average of over two hundred eggs each (this also without wheat or even pollard) must be considered as extremely satisfactory.

During the test two deaths took place, one in pen No. 1 and one in pen No. 2. These birds were replaced with others of the same age.

HOW THE TEST BIRDS WERE FED.

For all pens the morning mash was moistened with hot water, and the birds were given at each meal as much as they could eat without waste. In addition to the amount of meat-meal included in the mash, this material was also placed in a separate receptacle in each pen, and was always before the birds to pick at. This gave the birds to some extent an opportunity of balancing their own ration. In pens Nos. 1 and 2 the evening meal consisted of whole wheat, while in pens Nos. 3 and 4 whole oats were provided. In each case these grains were fed in straw littler, so as to induce the birds to take exercise. Green food chiefly chaffed green lucerne was supplied regularly and in abundance at midday, and was much relished by the birds. During the winter, when green lucerne was not available, turnips or mangels were thrown in whole for the birds to pick at. All the greed feed—lucerne, roots, &c., was grown at the station. Gravel, grit, and crushed oyster-shell, also clean water, were always left before the birds.

Referring to the tabulated results, it may be noted that the cost of food consumed is based on wholesale prices, delivered to the poultry-station; and the values credited for eggs are those realized on the Dunedin market.

Seed of Pohutukawa for Disposal.—Rev. J. H. Simmonds, of Wesley Training College, Auckland, has a quantity of freshly gathered pohutukawa-seed which he will be glad to distribute gratis to farmers and others wishing to make seaside plantings of this valuable shelter-tree. Applications for supplies should be made to Mr. Simmonds without delay.

Referring to the list of agricultural tractors represented in New Zealand, as published in the April *Journal* (p. 202), it may be stated that the "Emerson" tractor is manufactured by the Emerson Brantingham Implement Company, U.S.A., whose principal agents in New Zealand are Messrs. Hope Gibbons, Sons, and J. B. Clarkson (Limited), Wellington.

PRIVATE FORESTRY.

THE WAIRARAPA, MANAWATU, RANGITIKEI, AND WANGANUI DISTRICTS.

J. H. SIMMONDS, Auckland.

THERE are in the Wairarapa and Manawatu-Wanganui districts many plantations of valuable timber-trees. They are widely scattered, as are the homesteads to which they belong. A traveller passing through on the railways would scarcely suspect their existence. As the result of arrangements made by members of the Farmers' Union, the writer has been able to visit and carefully inspect a very large number of these plantations.

In the districts named, as in other long-settled parts of New Zealand, much of the planting dates back forty to sixty years. It may even be said that in very many cases the best of the planting was done by the first generation of settlers. So obvious is this truth that one is tempted to speculate upon its explanation. Were those early settlers home-makers in a sense and in a degree which we of to-day with all our lavish expenditure cannot quite understand or emulate? Did they appreciated the majesty and beauty of great trees as we do not? Or were they keenly practical men who realized the comfort and benefit of shelter for themselves and their stock? Did the same practical instinct tell them that the indigenous forest would rapidly disappear, and that a day would inevitably come when timber for all purposes would be scarce and dear? We may well suppose that the tree-planting spirit of those early times found strength in a combination of all these motives. But while especially praising the pioneers we must do justice to their successors. Some very valuable planting has been done in recent years; and in this report the old and the new will be regarded as forming one general aggregate of object-lessons.

It was not to be expected that busy farmers and settlers would always plant the best trees, or always plant their trees in the best manner. The intelligence and energy of the men who did or directed the work ensured a large percentage of good results; but some errors were made, as was unavoidable in work of so special and technical a character.

There have been planted in these districts too many trees that are of secondary economic value even when they grow and do well. Lombardy poplars, for example, though elegant and beautiful as trees, and useful in some cases for shelter, offer the settler but scant economic return for the land they occupy. Some of the other poplars are valuable for sawing into boards; but none of them yield good domestic fuel or

durable fencing-material. Most of them are liable to give trouble by throwing up suckers. Willows yield successive crops of good firewood but they are found growing in many places where larger and more valuable trees might easily have been established. Elms have spread by suckering, and become troublesome weeds without yielding any compensating return of large timber. In a similar way blackwood (*Acacia melanoxylon*) and silver-wattle (*Acacia decurrens*, variety *dealbata*) have proved to be weeds rather than profitable timber-trees. Thorny acacia (*Robinia pseudo-acacia*), after trial in several localities in the Wairarapa, is reported to be unsuitable for that district, and decidedly too poor a cropper to be worth growing.

In many of the plantations we see evidence of three very common errors in practice: (1.) Rapid-growing and slow-growing trees have been planted together, the result being that the slow growers have been either deformed or wholly suppressed. (2.) Valuable timber-trees have been too widely spaced, and then allowed to grow without any attention in the way of side-pruning. Hence to-day we see many otherwise splendid specimens hopelessly spoiled for either splitting or sawing by the number and strength of their side branches. (3.) Too generally, cattle and horses or sheep are admitted into the plantations. The presence of these animals reduces the risk of loss by fire; but, on the other hand, it wholly prevents the regeneration of the plantation. Neither nature nor the skill of man can successfully start new trees where animals are waiting to destroy them, and without new trees any forest or plantation must ultimately disappear. Cattle eat or break down every green shoot or branch within their reach, and horses will sometimes bark young trees that are a foot or more in diameter. Sheep are also very destructive while plants are small. Some of the old plantations now need interplanting with suitable shade-bearing species; but without the total exclusion of stock any attempt at such work would be futile. It is much better in the great majority of cases to exclude stock, and to protect from fire by other precautions. Where trees are planted for the purpose mainly of sheltering stock from the summer sun, regeneration of the plantation may have to be sacrificed to that purpose. One cannot at the same time enjoy two mutually exclusive benefits.

There still remain in these districts some remnants of the original native bush; and it is quite evident from experiments made on a small scale that certain of the indigenous shrubs and trees can be reproduced where stock are excluded and fires prevented. Mr. H. Morrison has an especially fine collection of indigenous shrubs in his grounds at "Awatoitoi," near Masterton; and in other cases beautiful native shrubs may be seen springing up under the shade and shelter of foreign forest-trees. Fair specimens of totara have been noted in several open situations. But no evidence has anywhere been found in these great districts to show that indigenous timber-yielders can be reproduced and matured fast enough to meet the present and prospective demand for firewood, fencing-material, and sawn timber. It is obvious wherever one turns that the needs of a growing population must be met by the assiduous and extensive cultivation of rapid-growing exotics. Failing this, timber famine is inevitable.

Two great groups of trees stand out as of paramount importance: they are the conifers and the eucalypts. Next to them in general economic value will probably come the oaks and nut-bearers. In national forestry conifers easily hold the first rank, for it is mainly upon them that we must depend for those immense supplies of soft wood annually used up in our industries and in the internal fittings of our dwellings. Moreover, conifers can grow and flourish in cold parts of the country where most other trees would fail. But the eucalypts, though they will never be grown in such large numbers in our national forests as conifers, are necessary as hardwood-yielders. Their timbers will be increasingly required for railway-sleepers, for the framework of railway rolling-stock, for drays and wagons, and for the wooden parts of agricultural implements. To the farmer the eucalypts are especially valuable because of their high merit as yielders of domestic fuel and fencing-wood; and as this report is mainly for farmers, and for farmers in districts where eucalypts can be cultivated with great facility and success, there can be no impropriety in giving these trees the first place in the descriptive notes that are to follow.

EUCALYPTS.

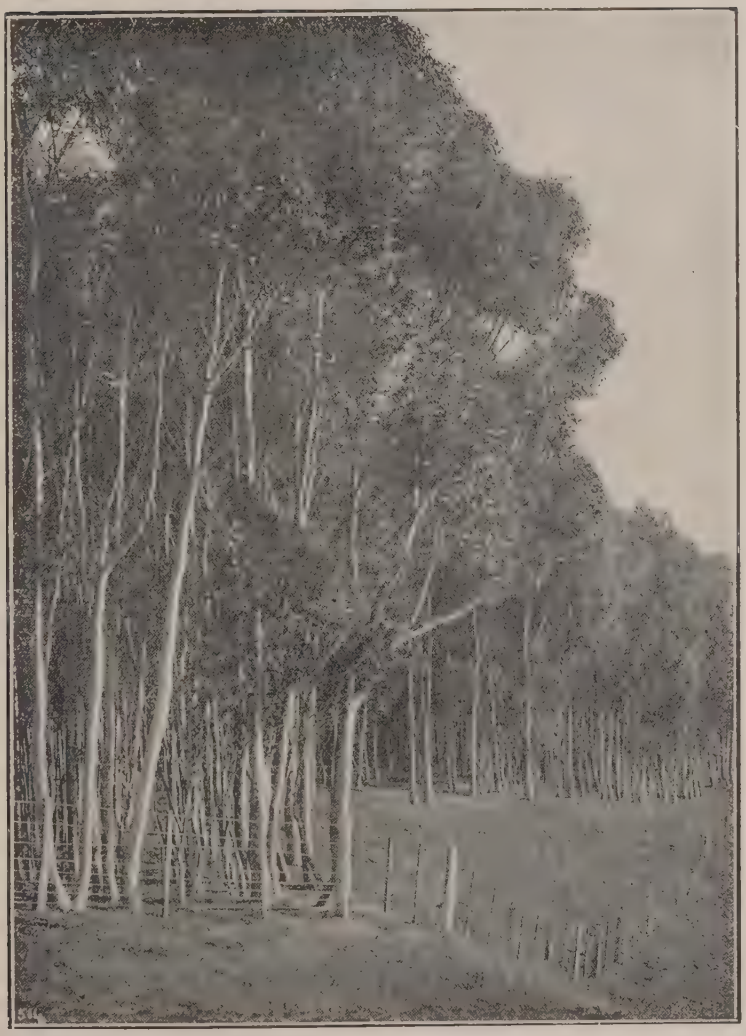
During his visits to the Wairarapa and Manawatu-Wanganui districts the writer has noted about thirty species of *Eucalyptus*. For the purposes of this report it will be convenient to first somewhat fully describe the species that were found doing well and are considered worthy of further cultivation as timber-yielders; then to briefly mention some other species found in the districts; and, thirdly, to give a list of valuable species recommended for experimental introduction.

I. SPECIES DOING WELL AND RECOMMENDED FOR FURTHER CULTIVATION.

E. Macarthuri.—The tree is a sturdy upright grower that throws out strong side branches in open situations, but forms a tall clean bole when closely surrounded by other trees. Its dead bark is rough and brittle and persists on both stem and large branches. Juvenile leaves stalkless, opposite, rather broad at base, tapering to apex; adult-tree leaves stalked, long, rather narrow. Buds and seed-cases very small, usually in sevens. The tree early develops a large percentage of pale-red mature wood, which has been known to last in the ground sixteen to twenty years. The timber can be split with moderate facility; it cracks radially in drying, and when sawn into planks and scantling must be seasoned with great care. Tops and waste yield fuel nearly equal in heating-power to coal. Mr. R. Reynolds, of "Trecarne," Cambridge, who has been using *Eucalyptus* timber for fencing and firewood for many years, is of opinion that *E. Macarthuri* is the best of the eucalypts for the general purposes of the farmer. The trees are attacked at their growing tips by insects, but their vitality is so strong that in any situation where the subsoil is deep and free and moisture within reach they will overcome this check and grow rapidly to a large size. The species is very easily propagated either by sowing *in situ* or by transplanting; it endures severe frost, but when planted near the sea needs a screen of hardy pines to protect it from the saline winds.

Specimens were discovered by the writer in the grounds of R. Perry, "Thorpelands"—a few fair trees; C. N. Stilborn, "Ngapopatu"—several large and quite mature trees; J. Langdon, "Larch Bank"—a fine stand of young trees, 60 ft. to 70 ft. high; Dr. Andrews, "Ica"—one large tree. From several of these trees it would be possible to obtain supplies of seed.

E. obliqua.—A rapid-growing tree of erect habit, with stringy dead bark persisting on stem and larger branches. Leaves broad and unequal-sided. Seed-cases rather large, egg-shaped, valves sunk. Timber splits freely and is excellent for sawing into boards and scantling; when fully mature lasts fairly well in the



STAND OF EUCALYPTUS CORYNOCALYX AT "FERNGLEN," MASTERTON.

(See page 340.)

ground. The species is very sensitive to frost in the seedling stage and resents transplantation, but otherwise it is very hardy and of wide range, doing well from near the sea-board to far inland and on almost any kind of soil.

Splendid specimens were noted in the grounds of J. Henderson, "Sea View"; H. A. Nevins, "Annedale"; C. N. Stilborn, "Ngapopatu"; Dr. Andrews, "Ica"; T. Taylor, "Beaumaris"; G. Laing, "Riversdale"; F. V. Kempton, "Elm Grove"; J. Martin, "Waiura"; W. J. Martin, "Huangarua"; W. B. Martin, "Puruatanga"; A. Martin, "Otaraia"; W. J. Phillips, Sandon; Simpson Bros., "Heaton Park," Marton; T. Whittington, "Westbery," Marton; and in numerous other localities all up the south-west coast. Many of these trees have for some time been large enough for conversion into sawn lumber or fencing-material. All are doing well, and from several of them there could be collected abundant supplies of seed.

E. viminalis.—The tree when of the best strain and grown under forest conditions makes a long clean bole with little taper. The dead bark falls away from branches and stem, leaving a smooth greenish-white surface. Juvenile leaves stalkless, equal-sided, tapering to the apex; adult-tree leaves stalked, long, rather narrow. Buds in threes, conical. Seed-case small, cup-shaped with rising rim and protruding valves. Mature wood early developed, straw-coloured, valuable for many purposes, known to have lasted fifteen years in the ground, excellent fuel. An inferior variety to be strictly avoided in collecting seed has low-spreading branches, rough dead bark persisting far up the stem, and flowers often in clusters of more than three. The species is very easily propagated either by sowing *in situ* or by transplanting; it is hardy and vigorous over a wide range in both Islands, but appears to be at its best where there are cold winters, as in Waikato and Canterbury. To overcome insect enemies and maintain rapid growth it must have a deep subsoil and plenty of moisture; planted near the sea it needs a screen of hardy pines to shield it from the saline winds.

Good specimens were found in the grounds of A. Ross, "Braemore"—several young trees; T. Cripps, Whareama—one splendid tree; W. J. Martin, "Huangarua," and W. B. Martin, "Puruatanga"—several large trees; and W. Perry, "Penrose"—one or two vigorous young trees. Specimens of inferior strain were noted in the grounds of H. A. Nevins, "Annedale"—one tree; F. V. Kempton, "Elm Grove"—two or three spreading trees; and J. C. Bidwill, "Te Maire"—one or two trees grown from seed collected at "Elm Grove." In the Manawatu-Wanganui area *E. viminalis* has either not been much planted or has not found a congenial home, two trees in Kimbolton Road, Feilding (H. Burrell), and a few at Bull's (Sir James Wilson) being about the only good specimens noted. Intending planters of this valuable species are advised to obtain their seed from H. A. Goudie, State Forester, Rotorua, who keeps stocks of this and other species collected under his own direction from approved trees.

E. regnans.—The tree grows rapidly to a great height and girth. Its dead bark persists on the lower stem and is there fibrous; from the upper stem and branches it comes away in ribbons, leaving a smooth surface. Leaves stalked, unequal-sided, broad. Buds with short point. Seed-case small, top-shaped, nearly always three-celled. Timber light-oak colour, easily split or sawn; when mature suitable for rails, gates, fencing-droppers, and any work in building-construction where not in contact with the ground. The species is finding for itself a congenial home in many parts of both Islands. It is well represented in the Wairarapa. T. Cripps, "Sevenoaks"; H. A. Nevins, "Annedale"; C. N. Stilborn, "Ngapopatu"; Matthew Dunn, "Willow Bank"; Dr. Andrews, "Ica"; F. V. Kempton, "Elm Grove"; W. J. Martin, "Huangarua"; W. B. Martin, "Puruatanga"; John O. Bidwill, "Pihautea"; and also W. J. Phillips, Sandon, can all show good specimens of *E. regnans*, and in several cases the trees have long been large enough for conversion into split or sawn lumber. From the largest and best of the trees mentioned abundant seed could be obtained for starting new plantations of this very valuable timber-yielder.

E. globulus.—This eucalypt is so well known under the title of "blue-gum" that there is little need to describe it. There is, however, great need to tell people that all "blue-gum" trees do not belong to one uniformly good strain or variety. A variety that has its flowers in threes is scarcely worth growing even for firewood. Strains that produce short twisted boles are similarly of low value. But what may be called the pedigree *E. globulus* has approved itself in many lands as a splendid and exceedingly valuable tree. It has large leaves and large single flowers,

and develops a tall, straight, clean bole of great size. Its timber is interlocked in texture and of high merit for many technical purposes. Being hard to crosscut and tough to split, it is best dealt with by sawing machinery. The species is much attacked by insect enemies, and when planted in a warm climate or on a dry upland may be killed right out by them. In the seedling stage it is very sensitive to frost, and yet it must have a cool climate. The conditions for its successful cultivation are a deep, moist subsoil and a winter sufficiently cold to check its enemies.

Much *E. globulus* timber has already been used in the Wairarapa. Mr. T. Cripps put in the ground twenty years ago posts split out of trees grown on his property, and finds them still sound. A tree felled by him in the winter of 1917 had a total height of 116 ft., a height to the first branch of 44 ft., and a girth of 10 ft. 8 in., 9 ft. above ground. The tree was split into fencing-posts, and was a remarkably fissile specimen for this species. A splendid stand of *E. globulus* near Martinborough is about to be sawn up into building-timber and firewood; and there are no doubt many other stands in the district that will be treated in a similar manner in due time. Everywhere a little inland from the south-west coast the species is equally thrifty, and in most of the old plantations it is represented by numerous specimens now mature enough for the sawmill.

E. rostrata.—This is the celebrated Murray "red-gum." Its native home is along the rivers and creeks of eastern Australia. Planted on good land where its roots can easily find moisture, and where the climate is mild, it grows rapidly to a large size. The dead bark is non-fibrous and comes off in scales or sheets. The leaves are stalked, long, rather narrow; branchlets drooping, and general aspect of foliage slaty green. Flowers numerous in umbel, lid of bud contracted into a slender beak-like point. Seed-case with rising rim and protruding valves. Both buds and fruits small and delicately formed. Mature wood red, strong, clean in the grain, durable in any situation. The tree has a tendency to make a crooked stem, hence must be grown in close plantations. The species suffers very severely from the attacks of insects upon its foliage, and will be satisfactory only where soil and moisture promote vigorous and rapid compensating growth.

Specimens have been noted as follows: In the grounds of H. H. Ryder, "Langdale," several large trees thirty to thirty-three years old; at "Elm Grove," three trees, one of which has a girth of 10 ft. 9 in.; at "Otaraia," five trees, one of which is 85 ft. high with a girth of 7 ft. 6 in.; in the grounds of W. Perry, "Penrose," a few vigorous young trees; and in Pukepapa Road, Marton, a number of large old trees (G. Fredericks) and some younger ones (J. Mitchell).

E. ovata (syn. *E. acervula*).—The species as at present understood includes two or three varieties. One variety is indigenous to Tasmania, where by a strange misuse of language it is called "red-gum." The others belong to Australia, where some botanists regard them as specifically distinct. The group or species, whichever it may be, is represented in New Zealand by numerous specimens, the best of which are of erect habit and grow very rapidly in their earlier years. The dead bark comes off the branches and upper stem in ribbons, but persists on the lower stem and is there scaly and ultimately rough. Leaves in juvenile stage oval; on the adult tree like an oval greatly elongated or sometimes long and falcate; in both stages stalked and often wavy. Buds low-conical, frequently in clusters of seven. Seed-case small, wide at the rim and narrow at the base like an inverted cone. Mature wood brown to straw-coloured; said to be hard and strong and to make excellent fuel; durability in contact with ground not yet ascertained. Easily propagated and very hardy.

Specimens have been noted in the Wairarapa as follows: At "Annedale," one fine tree near residence and a splendid stand of young trees in the pole stage across the river; at "Larch Bank," vigorous young trees; at "Awatoitoi," many young trees, some of which were found to be 40 ft. high with a girth of 1 ft. 9 in. at seven years from planting; and at "Otaraia," several young trees. In the Manawatu-Wanganui area this species is represented by vigorous specimens in a great many localities; but very few of them have developed into good timber-trees. Numerous large old trees at "Heaton Park" (near "Plain's House") are heavily branched low down and generally too crooked even for fencing-posts. For this condition of the trees climatic influences and bad forestry may both be partly responsible. Seed should be obtained from the State forests officers, Whakarewarewa, Rotorua.

E. corynocalyx (syn. *E. cladocalyx*).—The tree grows with moderate rapidity to a medium size. Its dead bark, which is non-fibrous, falls off, leaving stem

and branches more or less smooth. Leaves stalked, rather broad, lance-shaped; dark green and shiny on upper surface, paler beneath. Buds club-shaped and of indefinite number up to about twelve in the umbel. Seed-case long in proportion to its width, marked with longitudinal stripes, contracted towards orifice and stalklet, valves deeply sunk. Mature timber hard and very durable; used for railway-sleepers, telegraph-poles, and fence-posts. The species is a favourite for cultivation in its native home, South Australia and Victoria, and in California.

There is one excellent stand of this eucalypt in the Wairarapa: it is the property of Mr. Henry Bennett, "Fernglen." The total area is about 9 acres. The seed is said to have been obtained from South Australia by Sir Walter Buchanan about 1899, and to have been sown with a drill on a well-prepared surface in the month of November. Some of the trees are now 40 ft. to 50 ft. high with a girth of 2 ft. 6 in. The stand as a whole could have been greatly improved by suitable thinning in some places and interplanting in others. "Fernglen" is near the sea and enjoys a very mild climate. Settlers whose properties offer similar conditions should without delay make experimental sowings of this valuable eucalypt. Seed could be obtained from the "Fernglen" trees. The species is represented by healthy young specimens in the vicinity of Auckland and in Hawke's Bay, but has nowhere else in New Zealand yet done so well as at "Fernglen."

E. amygdalina.—(*a.*) The Australian variety: Dead bark persists on stem and large branches and is fibrous. Leaves in both stages similar to those of *E. viminalis*. Branchlets drooping. Buds numerous in cluster. Seed-case small, hemispherical. One large tree noted at "Ngapopatu." (*b.*) Tasmanian variety: Dead bark, often not fibrous and not persistent. Leaves usually very narrow. Buds and seed-cases similar to those of (*a*). Mature timber dark brown, very durable in ground. Growth rather slow, and ultimate size not large. Specimens may be seen at "Puruatanga," and seed could be collected there. Young trees were noted also at "Awatoitoi," about Palmerston North, and in the grounds of E. Short, "Parorangi," Feilding.

E. Risdoni (variety *clata*).—Tree grows rapidly with a fairly upright stem, and sheds its dead bark, which is non-fibrous. Juvenile leaves opposite in pairs and without stalks; adult-tree leaves stalked, long, rather narrow. Foliage as a whole has a drooping habit, and sometimes both leaves and twigs are touched over with a glaucous bloom. Buds numerous in cluster. Seed-cases shaped somewhat like a broad spinning-top with an almost flat upper surface; larger than those of *E. amygdalina*, but similar. Mature wood brown, hard, strong, durable in ground. Species hardy over wide range in New Zealand.

Young trees were found doing well at "Marangai" (H. G. Groves), at "Larch Bank," and at "Braemore"; larger trees at "Puruatanga." Seed could be obtained from the last-mentioned trees. A few fine specimens were also located in the plantations at "Heaton Park."

II. OTHER SPECIES NOTED AS GROWING IN THE DISTRICTS, BUT NOT RECOMMENDED FOR EXTENSIVE PLANTING.

E. citriodora.—Sub-tropical; "Greenbank," Marton (G. L. Marshall), two vigorous young trees.

E. coccifera.—Ornamental; suitable for cold localities; a few trees near Masterton.

E. coriacea.—Useful for shelter and fuel in cold localities; "Annedale," "Sea View."

E. ficifolia.—Ornamental only; several localities.

E. goniocalyx.—Not of much promise in New Zealand; "Awatoitoi."

E. Gunnii.—Suitable for cold districts in South Island. W. B. Martin, "Puruatanga"; T. Cripps, Whareama. In an exceedingly valuable old plantation at Oroua Downs, Foxton, now the property of H. J. Hammond, *E. Gunnii* has attained the dimensions of a forest-tree and is represented by numerous specimens. The trees are ripe for use, and it is hoped that experiments will without delay be made with the timber, which looks promising for hardness and durability.

E. haemastoma.—Hardy, but small; "Annedale."

E. leucoxylon.—Sheds dead bark, flowers sometimes crimson, seed-cases goblet-shaped; "Huangarua," "Elm Grove."

E. macrorrhyncha.—Of little promise anywhere in New Zealand; "Flag Creek."

EUCALYPTUS REGNANS.

A fine specimen, over 3 ft. in diameter, at "Ica," Whareama.

E. marginata (jarrah).—Sensitive to frost, very slow in New Zealand; "Awatoitoi."

E. radiata.—"Huangarua" (old plantation), fair trees.

E. sideroxylon.—Valuable ironbark; flowers sometimes crimson, seed-cases goblet-shaped; slow and small in New Zealand; "Flag Creek" (D. H. Speedy), "Waiura," "Elm Grove"; two fair trees in the grounds of W. Stewart, Levin; two or three trees at the Native Girls' School, Turakina, one of which has a height of 58 ft. and a girth of 6 ft. 2 in., bears bright-coloured flowers, and is very ornamental.

E. Stuartiana.—Rough bark, spreading branches, low value; several localities.

E. tereticornis.—Valuable tree similar to *E. rostrata*; "Ica," "Puruatanga," "Lethenty" (Sir James Wilson, Bull's).

Plantations of eucalypts in which many of the specimens are still too young for positive determination may be seen in the grounds of E. Short and H. J. Booth (Feilding), F. R. Wright (Levin), and about several other homesteads.

III. VALUABLE SPECIES RECOMMENDED FOR EXPERIMENTAL PLANTING IN SUITABLE LOCALITIES.

E. botryoides.—Tree ornamental; timber very durable; warm situations not far above sea-level.

E. eugenioides.—Valuable stringy-bark; "Langdale," one tree; low altitudes.

E. fastigata.—Similar to *E. regnans*, but said to yield better and more lasting timber; very hardy and vigorous over wide range in New Zealand.

E. Muelleriana.—A stringy-bark of very high merit; should do well on cool uplands.

E. paniculata.—The best of the "ironbarks"; requires good land and warm situation.

E. pilularis.—One of the most valuable of east Australian trees; doing splendidly about Auckland and in Hawke's Bay.

E. punctata.—Yields interlocked timber of great durability.

E. saligna.—A clean, rapid grower that yields timber of very high merit; requires deep subsoil and a climate free from severe frosts. Very strongly recommended for trial in sheltered situations where the soil is deep and moist. The species is represented by several vigorous old trees at "Killeymoon" (Ellis Bros.), near Bull's.

CONIFERS.

There is no collection of conifers in the Wairarapa or on the south-west coast such as may be seen in the State forests or in the plantations of T. W. Adams, of Greendale, Canterbury; but a few of those that are of greatest value and promise are well represented.

Pinus insignis (syn. *P. radiata*) is known by its general appearance, its ternate leaf-bundles, and its stout heavy cones. The word *insignis* (though *radiata* now claims priority) is peculiarly appropriate as its specific designation, for it is in many ways a remarkable or distinguished tree. It is easily propagated and grows with phenomenal rapidity to a very large size. It finds a congenial home on lowlands and highlands, on rich lands and poor lands, near the sea and far inland, in the warm north and in the cold south, its limit being only where frosts become extremely severe and compel it to give place to larch or spruce. *P. insignis*, grown under forest conditions, will make a straight, clean bole fit for the sawmill in thirty to forty years. Millions of feet of its timber have already been sawn up in New Zealand and utilized not only for temporary purposes, but also in the construction of dwellinghouses and other buildings. Timber from still young trees readily absorbs hot tar, and when so treated will last for a good many years in the ground. In older trees we find developing a resinous heart-wood, the durability and value of which have yet to be tested and appraised.

The world's main demand is for soft woods, and at the present stage of our experience in New Zealand *P. insignis* is certainly the tree that can yield us the greatest bulk of soft wood in the shortest time. On the question of quality there is still some difference of opinion, but this much seems quite certain: that wherever

the tree is well grown and properly milled and used prejudice against it gives place to strong appreciation. Every year brings it into greater favour both as a fuel-tree and as a yielder of sawn timber for a wide range of purposes. There are many stands of *P. insignis* in the Wairarapa and in Manawatu-Rangitikei-Wanganui; and the time cannot be distant when the travelling sawmill will be busy cutting some of them up into firewood and boards and scantling for the use of their owners or for sale.

Pinus pinaster.—An exceedingly hardy tree that freely propagates itself by the natural distribution of its seed. Bole rather short and sometimes crooked. Leaves in twos, thick. Cones long and tapering, often in clusters. Much grown near the coast in south-west Europe as a source of resin and turpentine, and also as a timber-yielder. May have a great future in coastal districts of New Zealand; but not at present recommended for planting in localities where larger-growing species will thrive equally well. Numerous well-grown specimens may be seen at "Ica"; "Letham" (A. Allison), Wanganui; and in numerous other localities.

Pinus muricata.—A sturdy spreading tree; very hardy. Leaves in twos. Cones ovoid, with sharp prickle at end of each scale. Numerous localities on south-west coast.

Pinus excelsa.—One good tree at "Beaumaris" (T. Taylor).

Three valuable trees recommended for trial are,—

Pinus Laricio.—Tree upright, clean-growing, handsome; leaves in twos; cones rather small.

Pinus ponderosa.—Tree sturdy, rapid-growing; leaves in threes, long; cones rather long, tapering, armed at end of each scale with a thorn-like prickle.

Pinus strobus.—Tree open-growing; leaves in fives; cones long and narrow.

Cupressus macrocarpa.—Planted on dry uplands or on poor gravelly subsoils this tree makes a short life and is nearly always unsatisfactory. On deep, moist subsoils it grows rapidly into the dimensions of a timber-yielder and is long-lived. The timber when well grown and mature can be either split or sawn with great facility. It is light to handle and clean in the grain, dressing under the plane to a handsome smooth surface. The durability of *C. macrocarpa* in contact with the ground varies, like that of totara and other timbers; but stout posts from mature trees may be safely expected to last twenty years. Unsplit limbs are just as lasting as the split stems, and even small branches will last a long time when used as garden-stakes. The thin straight branches stripped of bark make excellent and very lasting fencing-droppers. Objection has sometimes been raised that they will not hold the staples; but if the staples are of thin wire, fairly long, and turned a little in the driving, there will be no trouble. People in the Auckland Province have been using *C. macrocarpa* for both posts and droppers for many years, and the demand grows more keen with experience. On land belonging to Wesley Training College, Auckland, a fence 45 chains long has lately been erected in which all the posts and droppers are of *C. macrocarpa* from trees grown in the College plantations. The best parts of a good *C. macrocarpa* tree are too valuable for fuel, but the waste parts and small tops will serve well for that purpose.

Well-grown and badly grown specimens may be seen in many localities in the districts now dealt with. At "Puruatanga" (W. B. Martin) there is a stand of over sixty trees 70 ft. to 80 ft. in total height, and with straight boles measuring up to 7 ft. 6 in. in girth. The total product of such a stand in boards and scantling or in fencing-material would be very valuable. And the age of these trees is known to be only thirty years. One may admit that this example is exceptional and yet contend that *C. macrocarpa* propagated from the best parent trees and planted 6 ft. apart each way on deep, moist subsoil is a tree eminently well worth growing for the purposes and needs of the farmer. A little back from the sea in the Manawatu-Wanganui area this tree thrives splendidly, and is represented by thousands of vigorous specimens.

Sequoia sempervirens (Californian Redwood).—A tall tree with spreading branches. Stem with little taper. Bark thick, ultimately very thick. Leaves ½ in. to 1 in. long, dark green on upper surface, marked with two pale lines below, arranged on opposite sides of twig. Cones small, about ¾ in. long by ½ in. broad. Mature wood red, light, easily worked, durable; hence suitable for many purposes and of great value.

Splendid specimens were noted as follows: At "Sevenoaks" (T. Cripps), one tree 90 ft. high with girth of 8 ft., growing on flat where subsoil is free and moist, age forty-five to forty-seven years; at "The Pines" (H. F. Skey), Carterton, about twenty trees on good land, one of which has a height of 112 ft. and a girth at the base of 16 ft., and another about the same height with a girth of 9 ft. at 4 ft. above ground. Seedlings are springing up under these trees. The very large tree is forked, probably as the result of being broken when a sapling. Recently one or two of the other specimens have suffered some injury by breakage at the top. This evidence and reports received show that *S. sempervirens* needs protection against violent winds. The trees just mentioned are all large enough for sawing into boards and scantling, and a sample board from a broken branch exhibited by Mr. Skey showed that the timber would be of high quality. The age of the trees at "The Pines" was not ascertained. Even if we put it down at forty-five years, the result is wonderful, and should encourage people to plant this tree in all suitable situations, such as sheltered valleys or moist well-drained flats where it can have the protection of hardy pines.

The opinion has been expressed that *S. sempervirens* is the most valuable timber-tree in the world; but the value of any tree in relation to the timber-market is limited by its capacity for production to a millable size over a wide range of country, and this is a question that can be determined in any given case only by competent and persistent experiment in many localities. At Levin Mr. James Prouse about twenty-three years ago planted a few trees of *S. sempervirens* in his own grounds and a surplus of six specimens out of the same parcel in the Borough Scenic Reserve. The largest tree in the private grounds is now 44 ft. high with a girth of 4 ft. 8 in.; the largest tree in the reserve is 60 ft. high with a girth of 5 ft. 3 in. The superior growth in the reserve is due entirely to better conditions of subsoil and shelter.

Pseudo-tsuga Douglasii (Douglas Fir; "Oregon Pine").—The tree has an erect habit of growth, and attains in its native home, western North America, heights of from 100 ft. to 300 ft. Stem with little taper. Bark thin on young trees. Side branches and branchlets spreading in almost horizontal planes. Leaves 1 in. to 1½ in. in length, light to dark green on upper surface, striped with two pale lines beneath, distributed on opposite sides of twig in same plane as branchlets. Cones 2½ in. to 4 in. long. Scales deeply concave, broad, thin but strong; behind each scale and reaching beyond it a delicate bract (modified leaf) with three points, the central point being the midrib of the bract prolonged into a slender awn. Timber straw-coloured, light in weight, rather coarse in grain, strong, exceedingly durable in dry situations. This conifer is said to be the most widely distributed of all American trees. It has the promise of a great future in New Zealand. In the Wairarapa it is represented by vigorous specimens in various localities, but all still too young for the sawmill. Deep, moist subsoil seems to be necessary for its best development, and in all wind-swept localities it should be protected by a screen of hardy pines at sufficient distance to avoid overtopping and suppression.

It appears from recent research that *Pseudo-tsuga Douglasii* exists in two varieties—a coastal variety and an inland or mountain variety—and that nearly all the praise bestowed upon the species belongs to the coastal variety, the inland variety being relatively not worth growing. Nurserymen and others are advised to obtain their seed from the State forests officers at Whakarewarewa, who well understand the distinction and now import only the coastal variety.

American botanists now call the species *Pseudo-tsuga taxifolia*.

OAKS AND NUT-BEARERS.

It is not safe to assume that these two groups of trees will do well everywhere in New Zealand. Both require good land and a deep subsoil containing a large percentage of clay. Where oaks find a really congenial home they are very valuable as sources of food for pigs and poultry. To ensure a maximum period for the falling of the acorns several species should be grown. The splendid almost evergreen *Quercus lusitanica* and the quite evergreen *Quercus ilex* are recommended for trial in addition to the deciduous species already generally planted. Oak wood makes excellent domestic fuel, and well-grown boles can be sawn into valuable boards and scantling. The growing of nut-bearers for their fruit does not as yet seem to be a very promising enterprise,

PINUS INSIGNIS LARGE ENOUGH FOR MILLING.

"The Pines," Carterton.

but it is worth while to make careful experiments with some of the timber-yielding walnuts and hickories. It will be waste of time to plant either oaks or nut-bearers unless they are effectually protected against stock, especially against horses. Splendid specimens of *Q. lusitanica* and its variety *Q. Hodgkinsonii* may be seen in the grounds of Alexander Allison, "Letham," Wanganui.

PRACTICAL SUGGESTIONS.

SELECTION OF SPECIES.

Planters are advised to restrict their choice of species for timber-production to a few of the best in each group. In eucalypts, Mr. Richard Reynolds, of "Trecarne," Cambridge, speaking as a farmer after many years' experience and observation, recommends six species, the names and order of merit being as follows: (1) *E. Macarthuri*, (2) *E. viminalis*, (3) *E. fastigata*, (4) *E. obliqua*, (5) *E. regnans*, and (6) *E. eugenioides*. For localities where the climatic conditions are closely similar to those of middle Waikato the list may be commended without alteration. Where milder conditions prevail *E. saligna* and *E. pilularis* must be included; on cool uplands *E. Muelleriana* should replace *E. eugenioides*. The valuable red-gum *E. rostrata* has grown to a large size over a wide range in the North Island, and merits a thorough test under forest conditions in localities where the soil is moist and good and the winter temperature mild.

In conifers *Pinus insignis*, *Cupressus macrocarpa*, *Sequoia sempervirens* (Californian redwood), and *Pseudo-tsuga Douglasii* (Douglas fir) will usually meet all the requirements of the private forester. Seeing, however, that *P. insignis* shows some liability to attack by insects or by fungoid diseases, there may be sufficient reason to have in reserve one or two small blocks of *P. ponderosa*, *P. Laricio*, *P. strobus*, or *P. canariensis*, the first three of which should do well in inland localities and the last in sheltered situations near the sea.

The oaks and nut-bearers apparently most suitable for general planting have already been mentioned.

SEED AND PLANTS.

Much disappointment has followed in the past from incompetent or fraudulent collection and naming of tree-seeds. Planters have been the victims of nurserymen, nurserymen of seedsmen, and seedsmen of collectors. In many cases worthless trees have been grown under the names of those that are of high merit. Drastic reform is needed to the very root of the whole business. Wherever possible seed should in future be collected from local trees that have been competently named and approved. Where this is not possible we shall have to look increasingly to the State forests officers to help us. In the matter of plants, professional nurserymen should be encouraged whenever they are prepared to supply us at reasonable prices with exactly what we require; but where they cannot so supply us and are liable to press upon us what we do not want we must go to the State nurseries. In fairness to any nurseryman all large orders should be placed two years ahead, so that time may be allowed to procure the seed and prepare

the plants. When planters reach something like a consensus in limiting their choice of species nurserymen will know better what to do and will be able to prepare stocks without undue risk of having them left on their hands.

PROPAGATION.

Conifers, eucalypts, and such oaks as *Quercus ilex* and *Q. lusitanica* need great care in transplantation. The main secrets of success are previous preparation by wrenching, and afterwards, while the plants are being handled, continuous protection of the roots from strong sunlight or drying wind. Thousands of valuable plants are lost every year through the roots being allowed to become dry. The very bad transplanters should be raised in and planted out from flat boxes. Mossing and potting answer well, but are more expensive. Where practicable *Eucalyptus* plantations should be started by sowing the seed where the trees are to grow. The conditions necessary for success are similar to those required for grasses and clovers. The seed must be sown on a clean firm surface. It may then be lightly harrowed and rolled, or trampled by a mob of sheep, but must never be deeply buried. Half a pound to a pound of fertile seed will cover an acre with more than enough plants, the surplus becoming available for transplanting on to adjacent areas. Seed may be sown in autumn or spring, the latter being usually preferred.

DISTRIBUTION OF PLANTATIONS.

Managers of large farms and runs should distribute their plantations in such manner as to minimize the cost of haulage when the product is ready for use. On steep country, if quality of soil and other conditions permit, it will be wise to plant fairly high up, so that gravitation may assist in the carriage of the firewood and timber. A little thought on this aspect of the business at planting-time may easily save hundreds of pounds later on. It is extremely important also that the plantations shall be so placed as to give the greatest possible amount of protection against prevailing winds.

SPACING, THINNING, AND CUTTING.

To yield heavy crops of good timber, trees must be planted near together in wide belts or compact blocks. Single rows, narrow belts, or widely spaced plantations may be of use for shelter and firewood, but they rarely produce good timber. Much valuable land is in many cases wasted by them. Speaking generally, they do not and cannot pay. One chain may be regarded as the minimum width for any timber-tree plantation, and 6 ft. apart each way as the maximum spacing permissible for ensuring the suppression of side branches and for drawing the trees up to a due height. When the side branches have been killed or greatly weakened and the saplings well drawn up, thinning should commence so as to encourage diameter growth in the trees that are to be left. By the time the plantation has reached maturity successive thinnings may have reduced the number of trees per acre from about twelve hundred to three hundred, two hundred, or one hundred. In thinning you cannot follow a blind rule and cut out every alternate tree. Your object must rather be to remove all weak and ill-formed specimens and leave the vigorous and well-shaped

ones to grow, though the spacing may thereby sometimes become irregular. When the trees in a belt or block have reached maturity it is good practice to cut them down in sections, removing everything but the stumps and immediately replanting, or allowing the stumps to sprout and grow again if they will do so, as is often the case with eucalypts. Where, however, there is necessity for maintaining continuous shelter, resort must be had to the method of interplanting and subsequently removing the remaining large trees. On many farms the planting will have to be done below the plough-line on the sides and at the bottoms of deep gullies; but the principles laid down in this paragraph will still hold good. There must in every case be a sufficient mass of trees together to force the growth upward and ensure a long length of clean bole in the individual tree.

PURE AND MIXED PLANTING.

Mixed planting has been responsible for many losses and disappointments. Slow growers and rapid growers have been planted together, with the result that the slow growers have been suppressed and the rapid growers spoiled by having too much room. Generally, therefore, in laying down plantations it will be well to keep each species by itself and away from immediate contact with other species. But numerous examples show that in certain cases mixing can be practised quite safely and with mutual benefit to the associated trees. Conifers and eucalypts seem especially suited for growing together, provided no mistake is made about the rate of height-growth of the species selected. *P. insignis* makes happy fellowship with *E. Macarthuri*, *E. viminalis*, *E. obliqua*, *E. fastigata*, or *E. regnans*. A good example of *P. insignis* and *E. obliqua* growing together may be seen in the grounds of W. H. Becher, "Longhill," Levin. *Cupressus macrocarpa* also does well in association with eucalypts; but in this case the conifers should be planted in the ratio of three to one to the eucalypts—that is to say, with spacing of 6 ft. each way there should be planted all over the block three *C. macrocarpa* to one eucalypt. Then, when thinning-time comes two-thirds of the *C. macrocarpa* can be removed, and an equal number of cypresses and eucalypts left to grow at about 12 ft. apart.

SEASIDE PLANTING.

The reasons for planting trees near together in wide belts or compact blocks become still stronger when we have to face seaside conditions. Trees mutually befriend and protect each other, so that a thousand planted together may survive and yield good timber where ten of the same species would be dwarfed or killed to the stumps. It is obvious, however, that in coastal situations we cannot rely for protection altogether upon the extent and density of the plantation. It is necessary that the first few rows of trees on the seaward side shall in all cases be such as can endure without serious injury the full blast of salt-laden winds. The trees most readily propagated for this purpose at present are the hardy pines. Of these *P. insignis* easily comes first on the list for rapidity of growth and ultimate size. *P. muricata* and *P. pinaster* (*P. maritima*), though inferior in height-growth, are believed to be a little more strongly resistant to saline winds. Their place will be that of allies on the seaward side of a *P. insignis* belt.

SEQUOIA SEMPERVIRENS (CALIFORNIAN REDWOOD).

This tree, one of a number growing at "The Pines," Carterton, has a girth of 9 ft. at 4 ft. above ground, and a height of 95 ft.; age, about forty-five years. (See page 344.)

The *macrocarpa* cypress is a little less resistant to severe sea-winds than *P. insignis*, but makes exceedingly thrifty growth at a short distance from the coast. Most of the eucalypts are very sensitive to salt winds, and when planted near the sea must have a strong screen of hardy conifers. *E. obliqua* and *E. acervula* (syn. *E. ovata*) are amongst those that are sometimes found doing well without much protection.

Of all the trees at present available for planting round our North Island coasts the two that can best endure the hard conditions of an open sea-front are *Metrosideros tomentosa*, or pohutukawa, and *Araucaria excelsa*, or Norfolk Island pine. They are both very much neglected now, partly because their merits are not understood and partly because there is difficulty in obtaining plants; but it is safe to predict that they will both find increasing appreciation, and that when a sufficient demand arises nurserymen will prepare to supply ample stocks of plants.

M. tomentosa (pohutukawa) flourishes within a few yards of high-water mark, and maintains a sturdy growth on the seaward as well as on the landward side. Wind-driven spray from the sea does not injure it. After the first year or two it makes rapid growth to a height of 20 ft. or 30 ft., and then lives on to a great age. It can cling to rocks, but is not happy on loose sand, though when well established it can survive a heavy drift that buries its stem to a depth of several feet. As an outside screen to a native-shrubbery wind-break for a seaside homestead or orchard it is unsurpassed. Its timber, though rarely of large dimensions, is a hardwood of great value.

Araucaria excelsa is indigenous to a small island where the only winds that can blow must come from the sea. A salt-laden atmosphere is therefore its natural element, and sea-winds that to many trees would be like poison are to it congenial and refreshing. It grows rapidly and reaches a great height, maintaining a perfectly erect and symmetrical form in the most exposed seaboard situations. The strength of its root-system, the elasticity of its stem, and the distribution of its branches in open whorls enable it to endure without injury the fiercest gales. Planted in clumps on headlands or in belts on low-lying shore-lines it would soon provide effective shelter for less resistant trees. Its erect and open habit of growth would permit the interplanting with it of denser and lower-growing conifers. Thus for permanent shelter (not for timber-production) *Araucaria excelsa* could be planted 30 ft. apart each way and then interplanted with *Pinus muricata* or *Cupressus macrocarpa*. The pine or cypress would serve as a close under-story to the taller trees, and the combination would form a wind-break behind which the seaside homestead would enjoy a climate equal to that of the most sheltered inland valley.

So far as the writer is aware, there has not been any serious proposal in New Zealand to plant *A. excelsa* for its timber; but why not? People who have been in Norfolk Island say that it is there sawn up into boards and scantling and used in building houses. Mr. R. M. Laing, M.A., science master at the Christchurch Boys' High School, who has visited Norfolk Island for the purpose of studying its trees and plants, says that *A. excelsa* is still abundant there, especially on the western side of the island; that the trees grow large and tall, with

straight, clean boles; that they may be seen growing down to within 8 ft. or 10 ft. of high-water mark; that the timber is free from knots, smooth, white, and easily worked; that this is the only timber used on the island for building purposes; that the houses built by the first settlers were very lasting; that inferior durability of some more recently erected buildings has, in his opinion, been due to neglect of the care and skill formerly exercised in felling and seasoning the timber; that the timber appears to be of excellent quality for butter-boxes. Mr. Laing further states that there would be no difficulty in obtaining supplies of seed on the island. In his "Select Extra-tropical Plants" Baron von Mueller says that "the timber is useful for ship-building and many other purposes." The demand for soft woods of all kinds is urgent and increasing; and surely a tree that can quickly yield a large bulk of valuable softwood in situations where scarcely any other timber-tree will grow at all is worthy of competent experiment on a fairly large scale.

Metrosideros tomentosa (pohutukawa) and *Araucaria excelsa* (Norfolk Island pine) are both represented by vigorous specimens at Patea; and there seems no reason to doubt that wherever on this south-west coast the ground is sufficiently settled and firm to give them roothold they would thrive equally well. There is room for millions of them; and settlers on the coast are strongly urged to make trial plantings of both trees—especially of *A. excelsa*—as soon as circumstances will permit of the work being done.

TREES AND THE SAND-DRIFT PROBLEM.

Great areas on the south-west coast (North Island) are covered with drifting sand. They are not only unproductive, but a menace to valuable adjacent lands. Many people are asking what can and ought to be done. For a full and very able discussion of the question inquirers are referred to reports prepared for the Government by L. Cockayne, Ph.D., in 1909 and 1911, and now obtainable from the Government Printer. The subject is introduced into this present paper on private forestry for the purpose of showing that in many localities, without very heavy expenditure, trees may be used to hold the drifts and ultimately to convert them into sources of wealth. There are two chief methods by which the conquest of an ordinary coastal sand-drift may be attempted.

(1.) The work may be begun far out on what is called the foredune; that is to say, on the summit of the sand-mound near the shore. Fresh sand is continually being supplied from the floor of the sea. It is washed up by the waves at high tide and in heavy gales of wind. At low tide it becomes dry and is then driven up the slopes of the shore and onward inland by the prevailing sea-winds. The scheme of the fore-dune method is to stop the inland drift as near the source as possible. A strong post-and-wire fence or series of fences wattled with manuka or other scrub placed across the drift will serve for this purpose. Marram-grass (*Ammophila arenaria*), tree-lupine (*Lupinus arboreus*), or plants of forest-trees are as soon as practicable established on the sheltered area thus provided. The wind-driven sand coming up the seaward slope accumulates against the barrier, and may ultimately submerge it and necessitate further protection for the plants. The method, however

carried out, is extremely costly, and the results, so far as forest-trees are concerned, very uncertain. It is a method more suited for the Government or for a strong corporation than for private owners of land.

(2.) The other method starts the work on the landward side of the loose sand and in some cases on the firm ground not yet reached by it. The principles involved will be better understood if we briefly consider how sand-drifts have for long ages been reclaimed by nature herself independently of human agency. Nature's list of plants capable of growing on sand as soon as it ceases to drift about is very large, and her resources for the distribution of seed marvellous. When European settlement began on this south-west coast forty to sixty years ago nature's method was in full operation. Every quiet spot out on the drifts and dunes was quickly sown with seed, and in a short time covered with plants. The plants had no animal enemies, and therefore had their best chance in the battle against the drifts. These scattered patches of vegetation, however, did not constitute nature's main attack upon the sand. That came from the firm land, where there already existed a strong and abundant mixed flora. Sometimes the sand would submerge the fringe of the vegetation or penetrate far into it; but ere long the vegetation would regain what had been lost and win a little more. The taller and more dense and widespread became the scrub and bush the more effectually was the sweep of the winds arrested and the drift of the sand checked. The general tendency was towards building upward and outward the whole sand-dune system and clothing all its landward slopes with vegetation.

The magnitude of nature's achievement is witnessed by a thousand unmistakable records. Far remote from the present seashore in what are now well-grassed or cultivated paddocks may be traced gentle waves in the surface of the otherwise almost level ground. They are ancient sand-drifts. Intermediately between these and the sea are areas of mounds and ridges the sand-drift origin of which is more obvious though not more certain.

In many cases man by stripping away nature's protective covering has allowed the sand to again drift, to his own hurt and loss. What nature had accomplished through long decades and centuries has thus too often been undone in a few brief years. But, on the other hand, man by adopting the main principle of nature's method has sometimes surpassed her speed in attaining results. Marram-grass has been established over considerable areas in many localities; and in a few instances decisive results have been achieved by the planting of trees. Here are two notable examples of successful tree-planting.

After the railway from Foxton to Palmerston North had been laid down about thirty-five years ago the engineers found that part of it was in danger of being submerged by drifting sand. The drifts were still shallow, and a remedy was sought in planting them with blocks of pines. The sand was held and the railway protected. To-day the pines are tall forest-trees, and the effect of their presence is seen for a long distance both landward and seaward. On the seaward side the two species represented, *P. insignis* and *P. pinaster*, are both freely propagating themselves by the natural distribution of their seed, the prospect being that within twenty years' time another area equal to that

originally planted and nearer to the sea will be covered with large trees and thus added to the reclamation already secured. The situation where this very successful experiment has been carried out is rather remote from the sea (about two miles and a half), and therefore presented only a moderate amount of difficulty; but it is not on that account less valuable as an object-lesson, since there are very many situations of a similar character where the arrest of drifting sand is urgently needed.

At "Greenbank," near Marton, Mr. G. L. Marshall twenty years ago planted a belt of pines and eucalypts between his grass-land and a wide stretch of drifting sand open to the full blast of the sea-wind. When the trees were about 25 ft. high the sand reached them and buried the stems of the outside row to a depth of 10 ft. or more. Some of the eucalypts were killed; but the pines (*P. insignis* mainly) suffered no injury beyond the killing of such lower branches as were wholly or partially submerged. The sand-drift was arrested and diverted in a direction parallel to the coast-line. The grass-land was protected from invasion and has remained safe to this day.

No sand cover is equal to tall trees planted in large dense blocks. Such blocks effectually arrest the air-stream for a long distance on both sides, and thus neutralize the cause for the movement of the sand. They throw a far-reaching shelter for grass and stock; they yield supplies of fuel and timber; they enrich the sand with humus. If a time comes when they may be wholly removed, they will leave the land in a clean and fertile condition for the reception of clovers and grasses. Probably nothing will succeed so well and nothing will pay so well on sand-drift country as the extensive planting of suitable timber-trees, always provided that the work is carried out with due regard to nature's own procedure in covering loose sand with vegetation.

Pumpkins for pig-feeding have proved a very successful crop at Ruakura. Over 70 tons are available for the pigs this autumn and winter. The crop is grown adjacent to the piggeries.

Wood-ashes for Manuring.—The Chemist to the Department would be obliged if intensive farmers, vegetable-growers, and fruitgrowers would communicate with him regarding their requirements of potash in the form of wood-ashes, as a quantity may be obtainable. Address Box 40, G.P.O., Wellington.

New Zealand Milk and Butter-fat Record.—Mr. John Donald's Friesian cow Westmere Princess Pietertje finished her semi-official testing-period (in the Junior Four-year-old Class) on 12th June, with an aggregate yield of 24,199 lb. milk, containing 939·78 lb. butter-fat, thus establishing a greatly advanced New Zealand record under each heading. The new champion is due to calve on 16th July, which will complete her certificate-of-record. Notes on the subject will be contributed to the next issue of the *Journal* by Mr. Singleton, of the Dairy Division.

A ONE-MAN SHEEP-HANDLING PLANT.

THE accompanying plan and drawings are based on the model of sheep-yards, dipping-bath, draining-floor, &c., which have been installed by the Department for handling a small flock of sheep at Somes Island Quarantine-station. This plant has been found to answer its purpose so well in practice that particulars are now published for the information of small flockowners who may desire to provide similar facilities on their own farms.

The accommodation in the yards and draining and shearing shed, as shown on the plan, was provided for handling about a hundred sheep. For larger flocks the accommodation of both should be increased according to requirements. A bath of the dimensions shown should be suitable for dipping flocks of up to a thousand sheep.

The bath holds approximately 350 gallons of wash, which should be sufficient to dip 150 sheep carrying three months' wool, without refilling. It will accommodate three large or four small sheep at one time. The check-gate shown at the middle of the bath is a necessary feature, enabling the sheep to be held in the bath for the time required to ensure thorough immersion, which should not be less than one minute. The gate is easily manipulated, and by its use dipping can be done in this small bath as efficiently, although more slowly, as in a 60 ft. swim-bath. With the assistance of the check-gate and a convenient catching-pen, as shown on the plan, the dipping can be done conveniently by one man.

The draining-floor is of concrete, with a slight slope towards the settling-well, and is covered by a lean-to shed, which is used for shearing, storing tools, &c.

KEY TO PLAN, ETC.

Fig. 1. Plan of yards, &c.: A, yards; B, gates; C, race, 1 ft. 4 in. wide; D, drafting-gates, 3 ft. wide; E, draining and shearing shed, 12 ft. by 12 ft., with two gates 6 ft. wide in centre, to open as required during shearing or other operations; F, bath, 11 ft. long, 3 ft. 3 in. wide at intake, narrowing to 2 ft. 3 in. at shed end, shown in detail in Fig. 2; G, trap-door, 3 ft. high, made to slide up; H, settling-well for drainage (see Fig. 5); I, door, 6 ft. by 3 ft. 6 in., halved horizontally; J, window, 2 ft. by 1 ft. 6 in., to open; K, catching-yard for dip.

Fig. 2. Bath and entrance to shed draining-floor. The concrete sides are raised 3 in. above ground-level to avoid entrance of surface water, &c. The check-gate of strong small-meshed wire netting and stout hardwood frame in the middle of the bath is raised by turning the iron handle L over to the right.

Figs. 3 and 4. Detail of good types of fencing.

Fig. 5. Settling-well shown at H in Fig. 1.

Fig. 6. Detail of check-gate shown in Fig. 2.

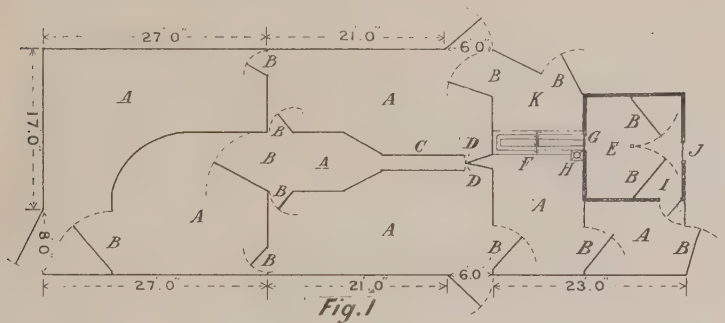


Fig. 1

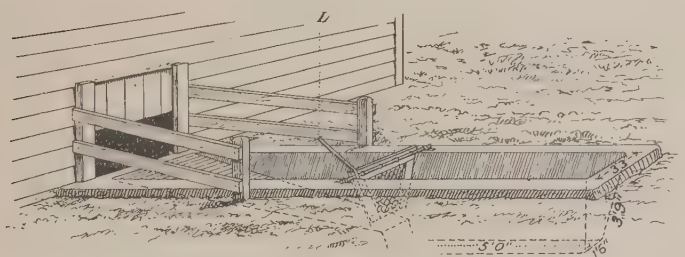


Fig. 2

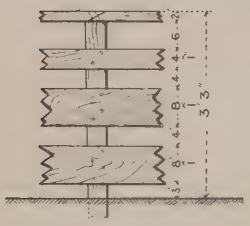


Fig. 3

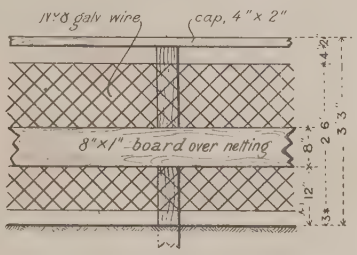


Fig 4

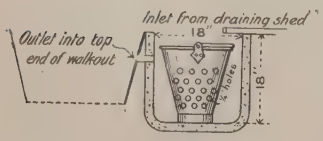


Fig. 5

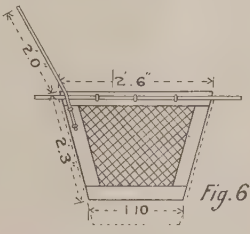


Fig. 6

ONE-MAN SHEEP-HANDLING-PLANT. (SEE KEY OPPOSITE.)

OIL-SPRAY TESTS AT ARATAKI.

An interesting set of experiments with oil sprays was carried out at the Arataki Horticultural Station during the past season. The objects in view were,—

(1.) To ascertain the value of two applications of oil at a reduced strength, one applied early and the other late in the dormant season, for the control of red mite and woolly aphis, as compared with the usual single dressing:

(2.) To ascertain the strength of oil in either case most effective in the control of the insects mentioned:

(3.) To ascertain the value of oil sprays at a reduced strength applied at the cluster-bud and colour-bud stages, as compared with (1) and (2) for the same purpose:

(4.) To ascertain how late the spray could be applied without damage to fruit or foliage.

A detailed report of these experiments has been furnished by the Manager of the station (Mr. T. E. Rodda), but it is not intended to publish the full results until the tests have been extended over another season. A few of the leading features, however, may be referred to provisionally.

In the case of the single oil application the experiment supported the recently accepted opinion that oil applied at a lesser strength than 1–12 cannot be relied upon to destroy mussel scale or the eggs of red mite. The two weaker applications, although possibly of value in the case of woolly aphis, are of little value against red mite.

The application of 6-4-40 bordeaux followed by oil 1–25 and 1–30 at the cluster-bud and colour-bud stages resulted very satisfactorily for the control of black-spot and red mite, but when applied at the pink stage considerable russeting and loss of fruit resulted.

As the close-cluster, open-cluster, colour-bud, and pink stages—terms used to mark different periods of spraying—are apt to be confused, the following definition of the terms by Mr. Rodda may be of use to orchardists not fully conversant with cluster-bud spraying:—

The fruit-bud, as the orchardist terms it, consists of an envelope or sac containing a number of diminutive buds which eventually give rise to a cluster of blossoms that later on develop into fruit. When the sap starts to operate in spring the envelopes burst and expose the internal arrangement of tiny buds nestling closely together. That stage is known as the "close cluster." When the buds have reached the stage when it is possible to see the upper portion of the stem of each bud-stalk the period is termed "open cluster." The third stage is "expanded cluster"—when the whole of the bud-stalks have drawn so far apart that every stalk can be traced to the base. The next stage is known as the "pink stage"—when each bud begins to burst and shows a faint tinge of pink at the apex. The fifth stage is termed the "advanced pink"—when the buds are showing up like miniature pink balloons but not actually opened out into flowers.

KILLING TREES WITH ARSENIC.

WHILE tree planting or conservation should be a prime consideration with the settler, it is sometimes necessary to destroy the growth of trees which under certain conditions have become a nuisance. In response to several inquiries the following information on the subject is furnished by the Horticulture Division :—

Various methods have been tried for killing trees, such as ring-barking, or drilling the trunks with auger-holes and filling the holes with sulphuric acid or nitric acid or arsenic. The most effective method has been proved to be a combination of ring-barking and arsenical poisoning. This method is to make a series of downward cuts with an axe, completely girdling the tree as near the ground as is possible. None of the chipped wood is to be removed, as this forms a kind of basin to hold the liquid. Poisoning should be done while the sap is down.

The best time to treat willows is while the leaves are falling, as these trees remain dormant for a very short time. If treated at the time stated suckering is almost entirely prevented. It often takes more than a year to kill trees by ring-barking, whereas they die in a few weeks, sometimes in a few days if small trees, by poisoning with arsenic.

A quick and effective strength is as follows : White arsenic, 1 lb. ; washing-soda, 3 lb. (or caustic soda, 2 lb.) ; water, 4 gallons. When a small quantity only is required caustic soda is the handiest, as it does not require boiling, the heat it generates being sufficient to dissolve the arsenic. Washing-soda, being cheapest, will be most appropriate for use in large quantities.

The vessel in which the boiling is done should hold at least three times as much as the mixture boiled, as it froths excessively during the boiling. A kerosene-tin holds 4 gallons. One pound of arsenic and 3 lb. of washing-soda may be boiled in 1 gallon of water. When the boiling is finished fill up with water and the mixture is ready for use. When large quantities are required the boiling may be done in an old iron boiler, and the concentrated mixture measured out into some other vessel containing the necessary quantity of water. While the boiling is being done have at hand a little cold water. If the mixture threatens to boil over, a little water thrown in will settle it down immediately. Be careful not to breathe the fumes, as they are very poisonous. The arsenic should be mixed to a paste with a little water before adding it to the soda solution. Boiling need only be continued till the arsenic is dissolved. The method of application is to pour the solution into the frill of cuts on the tree. One quart is sufficient for a tree about 4 ft. in diameter.

The vessels used should not be used for any purpose in connection with feeding or watering cattle, as the poison appears to be ineradicable from the metal. Cases have come under notice of cattle being killed by drinking water from vessels that had contained an arsenious solution.

Recent tests made at one of the Department's horticultural stations have shown the foregoing to be a very efficacious method of killing eucalyptus-trees. In one instance a tree 15 in. in diameter of trunk was treated. The foliage began to wither at the end of the second week, and in another week was dying fast. Other trials were made with a commercial arsenical weed-killer as the poison. This was applied at double the strength advised for killing weeds. It proved even more efficacious than the arsenic-soda mixture. The weed-killer would be the most convenient for use where a small number of trees are to be killed. The arsenic-soda mixture would be the cheaper where large numbers of trees had to be treated.

THE INDIGENOUS TANS AND VEGETABLE DYESTUFFS OF NEW ZEALAND.

PART II.—EXPERIMENTAL.

B. C. ASTON, F.I.C., Chemist to the Department.

It has been stated that the old-time Maori excelled the *pakeha* in the production of brilliant fast colours, but, perhaps with the exception of black, the author can find little evidence of any brilliant Maori colour produced by dyeing processes. The black coats of the early missionaries under the influence of the New Zealand sunshine and rain certainly may have suffered in comparison with the fast blacks with which the Maori dyed his phormium cloths. To get really brilliant and lasting colours the Natives worked into their mats and woven fabrics the naturally-coloured portions of birds, animals, and even plants. From birds they obtained the blue-black feathers of the tui; the white feathers of the pigeon, white heron, kiwi, albatross, and tui; the red feathers of the kaka parrot and perhaps the amokura (tropic-bird); the green feathers of the parakeet (kakariki) or ground-parrot (kakapo) or pigeon. From the native dog they obtained black and white hair with which they ornamented their mats. The bright-yellow leaves of the common seashore plant *Scirpus frondosus* (pingao) were used for making into girdles and small kits, and for ornamenting with a yellow thread some kinds of kits. The most interesting fact, as showing that the Maori appreciated European colours, is that they unravelled the woollen yarn from the highly coloured nightcaps or neck-cloths bartered to them by the early visitors to these Islands, and used the yarn so obtained for working into the ornamental borders of their most prized *kaitakas*. Old-time specimens of these may be seen in both the Auckland and Wellington Museums, where the bright red and blue threads may easily be identified as wool, not phormium.

NATURAL DYESTUFFS.

Owing to the war the natural dyestuffs are attracting a larger share of attention. A considerable increase in the consumption of natural as against synthetic or artificial dyestuff is reported from America (Jour. Soc. Chem. Ind., 1918, vol. 37, p. 57B). Before the war the United States imported 90 per cent. of its dyes and most of the intermediates used in making those manufactured in the country. Only seven firms made coal-tar colours, working either at a loss or without profit. At present there are over ninety, as well as one hundred making intermediates. Considerable progress has been made in the utilization of natural dyes; it is now possible, for example, to supply the Army with softer, heavier, and warmer cloth dyed with natural colours than if direct or sulphur dyes were used. The discovery of quick-acting mordants has made jig-dyeing with natural dyes possible. These are eminently fast to soap and soda, and reasonably fast to light. In this new method the wood of the osage orange (*Maclura aurantiaca*), a sister species to the fustic tree (*Maclura* or *Morus tinctoria*), is used. Osage orange may be mixed with any other natural dye and practically any artificial colour to dye cotton, wool, silk, felt, paper, leather, and wood.

The cessation of the export of synthetic indigo from Germany has had a very favourable effect on the manufacture of natural indigo. The total area of land under indigo crop in India in 1917 was 756,400 acres, or five times greater than it was at the beginning of the war. The discovery is announced from the Central Laboratory of the Government-General of Korea of a new vegetable dye, "shinnamu," from the leaves of a species of maple, and specimens of dyed yarns have been exhibited by the Board of Trade in London (Journ. Soc. Chem. Ind., 1918, vol. 37, p. 75R).

NEW ZEALAND TANS AND DYES.

Since the publication of Part I of this article in the last August and September numbers of the *Journal* progress has been made in the investigation of the dyeing properties of the genus *Coprosma* and in the determination of the tannin-content of New Zealand trees. The work of collecting, sampling, and analysing some hundreds of specimens of barks from forest-trees at all altitudes and seasons of the year has been no light task, and has been accomplished with the help of Mr. Leighton, Laboratory Assistant, and two cadets. In the laboratory these barks were broken and air-dried, and finally ground to a fine powder in an "Enterprise" grit-machine. The method used was that of the American Association of Official Agricultural Chemists (see Journ. Assn. Off. Ag. Chemists, vol. 1, No. 4, pp. 53 *et seq.*), except

in one particular, the extraction apparatus being home-made. The following are the assays for tannin calculated on the bark dried at 100° C. :—

ASSAYS FOR TANNIN-CONTENT OF NEW ZEALAND TREES.

Lab. No.	Date collected.	Locality, County, and Altitude.	On Air-dried Bark.*			Calculated on Bark dried at 100° C.	Remarks.
			Total Water-extract.	Non-tannins.	Tannin.	Tannin.	
		Fagus (*Nothofagus*) *fusca*, Red Beech or Birch.	%	%	%	%	
J/254	20/8/17	Kaitoke, Hutt, 800 ft.	15·9	5·4	10·5	12·0	From old trees.
443	18/11/17	Kapakapanui, Horowhenua, 500 ft.	14·1	5·1	9·0	10·0	From old trees.
464	25/11/17	Rimutakas, Featherston, 1,760 ft.	14·8	5·5	9·3	10·3	From old trees.
467	25/11/17	Rona Bay, Hutt, 1,000 ft. ..	16·1	7·7	8·4	9·3	Young smooth-barked trees.
564	15/12/17	Whangamoa Hill, Waimea, 1,000 ft.	13·5	5·3	13·9	9·5	From old trees.
565	16/12/17	Dun Mountains, Waimea, 2,500 ft.	9·8	4·3	5·5	6·2	From young smooth-barked trees.
570	17/12/17	Glenhope, Waimea, 1,270 ft. ..	19·0	8·5	10·5	11·3	From old trees.
574	21/12/17	Riwaka Hill, Waimea, 2,850 ft. ..	16·7	5·9	10·8	12·1	From old trees.
576	22/12/17	Takaka, Takaka, near sea-level ..	19·9	7·9	12·0	13·6	Very rough - barked trees.
577	22/12/17	Takaka, Takaka, near sea-level ..	18·9	8·0	10·9	11·8	Young smooth-barked trees growing with J/576.
703	16/3/18	Pakuratahi, Hutt, 800 ft. ..	16·3	5·0	11·3	12·9	Old rough-barked trees.
706	16/3/18	Pakuratahi, Hutt, 800 ft. ..	12·7	4·5	8·2	9·1	Young smooth-barked trees growing with J/703.
K/ 18	29/3/18	Westhaven, Collingwood, sea-level	13·9	4·4	9·5	11·0	Young smooth-barked trees.
82	28/4/18	Eastbourne hills, Hutt, 1,000 ft...	15·7	5·0	10·7	14·2	Old rough.
83	28/4/18	Eastbourne hills, Hutt, 1,000 ft...	13·0	4·8	8·2	9·2	Young smooth.
118	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	14·9	5·8	9·1	11·0	Young.
119	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	14·1	4·6	9·5	11·0	Old.
130	18/5/18	Rimutakas, Featherston, 1,760 ft.	15·3	6·2	9·1	10·5	Young.
		Fagus (*Nothofagus*) *Solandri*, Black Beech or Birch.					
J/266	25/8/17	Wallaceville, Hutt	13·4	6·5	6·9	8·0	
466	25/11/17	Rona Bay, Hutt, 1,000 ft. ..	13·0	6·2	6·8	7·3	Smooth-barked trees.
474	1/12/17	Hayward's, Hutt	11·2	5·5	9·0	7·4	Smooth- and rough-barked trees mixed.
561	15/12/17	Pelorus Valley, Marlborough ..	16·1	7·6	8·5	9·6	Rough-barked trees.
571	17/12/17	Glenhope, Waimea, 1,270 ft. ..	21·8	15·5	6·3	7·0	Young smooth-barked trees.
572	18/12/17	Glenhope, Waimea, 1,270 ft. ..	18·8	9·4	9·4	10·5	Old trees growing with J/571.
705	16/3/18	Pakuratahi, Hutt, 800 ft. ..	16·1	6·4	9·7	11·0	Rough bark.
K/ 15	30/3/18	Riwaka hills, Waimea, 3,000 ft ...	15·5	7·3	8·2	9·6	Rough-barked trees.
84	28/4/18	Eastbourne hills, Hutt, 1,000 ft...	15·3	8·2	7·1	8·4	Smooth-barked trees.
85	28/4/18	Eastbourne hills, Hutt, 1,000 ft...	18·8	8·0	10·8	13·0	Rough-barked trees.
		Fagus (*Nothofagus*) *Menziesii*, Clinker Beech or Birch.					
J/349	30/10/17	Kapakapanui, Horowhenua, 3,000 ft	13·4	4·6	8·8	9·8	Old trees.
465	25/11/17	Rimutakas, Featherston, 1,760 ft.	6·6	3·2	3·4	3·7	Smooth-barked young trees.
563	15/12/17	Whangamoa Hill, Waimea, 1,000 ft.	12·9	4·5	8·4	9·7	Rough - barked old trees.
566	16/12/17	Dun Mountain, Waimea, 2,500 ft.	10·7	5·9	4·8	5·4	Young smooth-barked trees.
569	17/12/17	Glenhope, Waimea, 1,270 ft. ..	10·3	3·6	6·7	8·0	Old trees.
575	21/12/17	Riwaka Hill, Waimea, 2,850 ft. ..	12·1	4·4	7·7	9·0	Very old trees.
690	18/12/17	Tawanui, Clutha	13·2	5·3	7·9	9·0	Very thin.
K/ 21	30/3/18	Westhaven, Collingwood, 900 ft...	12·6	4·2	8·4	9·7	Very thin.
131	18/5/18	Rimutakas, Featherston, 1,760 ft.	12·1	4·6	7·5	8·7	
		Elaeocarpus dentatus, Hinau.					
J/206	30/6/17	Ngaio, Hutt, 300 ft.	15·5	8·0	7·5	8·8	Old trees.
252	20/8/17	Ngaio, Hutt, 300 ft.	16·8	9·0	7·8	9·1	Old trees.
448	18/11/17	Kapakapanui, Horowhenua, 500 ft.	11·2	7·3	3·9	4·4	Old trees.
484	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	16·4	12·2	10·9	4·7	Old trees.
709	16/3/18	Pakuratahi, Hutt, 800 ft. ..	13·2	5·8	7·4	8·4	Old trees.
712	23/3/18	Ngaio, Hutt, 300 ft.	13·9	6·2	7·7	9·6	Old trees.
K/ 70	25/4/18	Akatarawa Valley, Hutt ..	12·9	6·8	6·1	6·8	Smooth.
78	27/4/18	Tinakori hills, Hutt	14·3	7·4	6·9	7·8	Smooth.
86	28/4/18	Eastbourne hills, Hutt					

* The thoroughly air-dried barks contain 10–16 per cent. of water.

ASSAYS FOR TANNIN-CONTENT OF NEW ZEALAND TREES—*continued.*

Lab. No.	Date collected.	Locality, County, and Altitude.	On Air-dried Bark.*			Calculated on Bark Dried at 100° C.	Remarks.
			Total Water-extract.	Non-tannins.	Tannin.	Tannin.	
				Elaeocarpus Hookerianus, Pokaka.			
			%	%	%	%	
J/362	15/12/17	Pelorus Valley, Marlborough ..	15·2	9·7	5·5	6·3	Young tree.
613	22/1/18	Rona Bay, Hutt	17·9	10·9	7·0	8·0	Mature tree.
482	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	22·5	12·8	9·7	10·8	Mature tree.
K/ 20	30/3/18	Westhaven, Collingwood, 900 ft.	22·6	11·1	11·5	13·3	
				Weinmannia racemosa, Tawhero or Kamahi.			
J/258	20/8/17	Kaitoke, Hutt, 800 ft.	17·5	5·7	11·8	13·3	Old tree.
449	18/11/17	Kapakapanui, Horowhenua, 500 ft.	20·0	5·0	15·0	17·2	Old tree.
487	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	20·7	6·1	14·6	16·6	Thin.
691	18/12/17	Tawanui, Clutha	26·7	8·8	17·9	20·6	Thick.
704	16/3/18	Pakuratahi, Hutt, 800 ft. ..	24·2	5·6	18·6	21·4	
K/ 19	29/3/18	Westhaven, Collingwood, sea-level	23·0	6·3	16·7	20·0	Thick.
69	25/4/18	Akatarawa Valley, Hutt ..	16·4	3·2	13·2	18·2	Smooth and thin.
71	25/4/18	Akatarawa Valley, Hutt ..	21·4	5·5	15·9	20·5	Thick.
113	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	21·8	5·2	16·6	19·4	
114	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	25·0	7·3	17·7	20·5	
122	7/5/18	Westhaven, Collingwood, sea-level	17·0	9·8	7·2	8·2	Very thin.
				Quintinnia serrata.			
K/ 24	30/3/18	Westhaven, Collingwood, 900 ft...	17·1	9·5	7·6	9·0	
				Dacrydium cupressinum, Rimu or Red-pine.			
J/445	18/11/17	Kapakapanui, Horowhenua, 500 ft.	12·8	4·5	8·3	9·2	Mature trees.
483	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	14·1	5·4	8·7	9·8	Mature trees.
708	16/3/18	Pakuratahi, Hutt, 800 ft. ..	11·3	4·4	6·9	7·9	Mature trees.
K/ 72	25/4/18	Akatarawa Valley, Hutt ..	10·1	2·9	7·2	9·3	
79	27/4/18	Tinakori hills, Hutt	14·4	5·2	9·2	11·0	
				Dacrydium Colensoi, Yellow-pine.			
K/ 22	30/3/18	Westhaven, Collingwood, 1,150 ft.	14·0	8·1	5·9	6·9	
				Podocarpus ferrugineaus, Miro.			
J/319	20/8/17	Kaitoke, Hutt, 800 ft.	12·1	7·2	4·9	5·5	
447	18/11/17	Kapakapanui, Horowhenua, 500 ft.	5·7	4·5	1·2	1·3	
485	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	12·0	6·5	5·5	6·1	
				Podocarpus dacrydioides, Kahikatea or White-pine.			
J/444	18/11/17	Kapakapanui, Horowhenua, 500 ft.	5·9	3·4	2·5	2·8	
K/ 17	29/3/18	Westhaven, Collingwood, sea-level	5·5	2·5	3·0	3·5	
				Podocarpus spicata, Matai or Black-pine.			
J/488	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	5·3	3·6	1·7	1·9	
707	16/3/18	Pakuratahi, Hutt, 800 ft. ..	6·9	3·2	3·7	4·2	
				Metrosideros robusta, Northern Rata.			
J/446	18/11/17	Kapakapanui, Horowhenua, 500 ft.	18·6	6·4	12·2	13·6	Old tree.
K/ 81	27/4/18	Tinakori hills, Hutt	13·6	5·4	8·2	10·4	
87	28/4/18	Eastbourne hills, Hutt.. ..					
120	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	14·6	6·1	8·5	9·9	
				Phyllocladus trichomanoides, Toatoa, Tanekaha, or Celery-pine.			
J/481	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	33·3	14·2	19·1	21·4	Very old tree (outer bark).
481A	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	22·3	10·5	11·8	13·2	Very old tree (inner bark).†
578	23/12/17	Westhaven, Collingwood, sea-level	20·4	8·8	11·6	13·0	On sandhills.
K/ 16	29/3/18	Westhaven, Collingwood, sea-level	15·8	6·1	9·7	11·4	,,
				Phyllocladus alpinus, Mountain-toatoa.			
J/573	18/12/17	Glenhope, Waimea, 1,270 ft. ..	13·4	7·0	6·4	7·1	
K/ 23	30/3/18	Westhaven, Collingwood, 1,200 ft.	8·3	4·7	3·6	4·2	
				Phyllocladus glaucus.			
K/117	13/5/18	Mamaku, Rotorua, 1,750 ft. ..	22·2	11·2	11·0	12·6	

* The thoroughly air-dried barks contain 10–16 per cent. of water. † Containing much young wood.

ASSAYS FOR TANNIN-CONTENT OF NEW ZEALAND TREES—*continued.*

Lab No.	Date collected.	Locality, County, and Altitude.	On Air-dried Bark.*			Calculated on Bark dried at 100° C.	Remarks.
			Total Water-extract.	Non-tannins.	Tannin.	Tannin.	
		Knightia excelsa, Rewarewa or Honeysuckle.	%	%	%	%	
J/442	18/11/17	Kapakapanui, Horowhenua, 500 ft.	10·7	4·0	6·7	7·3	
		Aristotelia racemosa, Makomako or Wineberry.					
K/73	25/4/18	Akatarawa Valley, Hut ..	12·0	6·9	5·1	6·3	
		Coriaria ruscifolia, Tutu.					
K/74	25/4/18	Akatarawa Valley, Hutt ..	12·2	7·1	5·1	6·4	
		Eugenia maire, Swamp-maire.					
J/256	20/8/17	Kaitoke, Hutt, 800 ft. . ..	16·9	9·2	7·7	9·3	
		Ixerba brexioides, Teddywood.					
J/486	7/12/17	Mamaku, Rotorua, 1,750 ft. ..	14·8	9·4	5·4	6·0	
		Actryon excelsum, Titoki.					
K/80	27/4/18	Tinakori hills, Hutt . ..	7·8	3·3	4·5	5·8	

* The thoroughly air-dried barks contain 10–16 per cent. of water.

Examination of the foregoing results seems to show that the contents of tannin in the bark of New Zealand trees of the genus *Fagus* (or *Nothofagus*), the beech, or "birch" of the settler, is influenced more by the age of the tree than by any other factor. Under similar circumstances it would seem that a smooth-barked tree will give a less percentage of tannin than a rough-barked (old) tree. The genus *Elaeocarpus*, containing the hinau and the pokaka, may prove to contain less tannin in summer than in spring, and the pokaka may contain more tannin than the hinau, but more analyses are necessary before coming to a conclusion. In the coniferous trees the large amount of tannin yielded by the rimu, or red-pine, is rather remarkable compared with that yielded by the other coniferæ examined—namely, matai (black-pine), kahikatea (white-pine), and miro. The comparatively large amount in the rimu-bark, of which there are such huge quantities available at the sawmills, suggests that an extract could be profitably made from that tree. The amount of tannin in the matai, kahikatea, and miro is so small as to render further investigation with these trees unnecessary. The large amount of tannin found in *Metrosideros robusta* (the northern rata) warrants further investigation, although the bark itself is thin and the yield of bark per tree is small compared with that of other trees of similar size. On the other hand, the bark is easily removed from the tree, and may be pulled off in long strips.

Dyeing Experiments. — Numerous dyeing experiments have been conducted with bark and wood of various species of *Coprosma*. Those

species of large size and abundant occurrence round Wellington which gave indications by preliminary tests of possessing tinctorial powers were *Coprosma grandifolia, C. lucida, C. foetidissima,* and *C. areolata.* As the first is the most abundant, and the one from which it is easiest to obtain a quantity of material, attention was concentrated on that species, with the result that the author is now able to give preliminary directions to those interested—for instance, home industries and spinning societies—for dyeing with both the bark and the wood of the kanono or tree-karamu (*C. grandifolia*). After comminuting the material the author employs a very dilute alkaline (caustic soda) steep with gentle heat. Some fermentation or bacterial action takes place, as a not unpleasing smell develops, together with acidity. Repeated extractions with weak lye finally remove most of the colouring-matter. The filtered extracts are the dye-bath in which any suitably mordanted woollen goods may be dyed by boiling for an hour. With chrome mordants the colours are quite fast to soap and light. Very beautiful shades of red, red-brown, brown, and purple-red may thus be obtained on wool. The two very common species, *C. Baueri* (taupata) and *C. robusta,* only possess very feeble dyeing-properties.

*Notes on the Chemistry of Coprosma grandifolia.**—When an alcoholic solution of *Coprosma grandifolia* bark is evaporated, and the mass of crystals separating are dissolved in ammonia and the solution filtered, baryta-water precipitates from the deeply coloured solution a purple lake, which when washed with water and dissolved in acetic acid yields a brown precipitate which may be crystallized from alcohol and constitutes "A" body. The filtrate from the barium lake of "A" body, after acidifying with sulphuric acid and acetic acid, on shaking with ether on evaporation yields crystals of "B" body. The following are the characters of these two compounds:

—	Melting-point.	Colour Reaction with Caustic Soda.	Colour Reaction with Concentrated Sulphuric Acid.	Dyes Chrome Mordants on Wool.
"A" body—sublimes in iridescent brick-red needles at about 200°C. with violet vapour	270–272° C.	Violet-blue	Violet-blue	Violet.
"B" body—sublimes in canary-yellow crystals above 200° C.	285–286° C.	Brick-red	Orange ..	Brown shades.

From alizarin "A" body differs in the colour of the crystals, the melting-point, and the colour reaction with caustic soda.

* Fabrics are dyed by the action of bodies usually crystalline and derived from minerals, plants, or animals. It is a huge economic advance to manufacture from mineral or inorganic sources those animal or plant dyes which have stood the test of ages. To do this it is first necessary to isolate and study the colour-forming bodies from the plant or animal. From the knowledge thus acquired it is then easier to attempt the manufacture, which was accomplished, for instance, in the case of the artificial indigo, and alizarin (replacing madder).

DIRECTIONS FOR DYEING WOOLLEN GOODS WITH COPROSMA-BARK OR WOOD OF ROOT.

Coprosma grandifolia, the kanono or tree-karamu of the Maori, is a handsome shrub or small tree, with large light-green leaves about the size and shape of those of the karaka, but of a much lighter green colour, and with a bright-yellow inner bark. It is a common tree of the bush around Wellington, but is most abundant in bush-clearings at about 1,000 ft. on the hills. In some Rimutaka hills, for instance, it may be found almost to the exclusion of other shrubs, coming up in what foresters would call a pure stand. Both the bark and the yellow wood may be used for dyeing wool with mordants, and perhaps without; but experiments on this point have not been concluded. The best source of material is an old tree—the larger the better. This may be loosened by digging round the root, the object being to get as much of the root as possible, as it is the root-bark and root-wood which are richest in colouring-matter. The roots having been loosened and cut at one side, the tree may be pushed over and the bark of the stem collected by inserting a knife under it and peeling the bark off. If portions of the trunk are very yellow these may be cut into suitable lengths and taken to the laboratory or dye-works. The roots in winter will probably be found to be yellow throughout, and may be cut up without previously barking, and the work of further separation reserved for the dye-house.

Arrived at the laboratory, the roots are washed with water to remove adhering earth, and the root-bark may then be removed and added to that of the stem. The mixed bark is weighed, and may then be put through a mincing-machine of the "Enterprise" type and reduced to a fine pulp. Water may be added from time to time to enable the bark to be more easily put through the machine. The pulp is now mixed with sufficient water to enable it to be mixed into a thin gruel-like consistency. A 10-per-cent. caustic-soda solution should be made up, and portions of this added to the pulp from time to time to dissolve out the dye from the bark. The soda should be added cautiously, with constant stirring, until the pulp becomes a purple colour or until a drop of the liquid placed on a piece of red litmus paper turns it blue. More soda may have to be added from time to time as the liquid becomes acid.

After standing in a warm place for some hours the pulp may be tipped on to a filter composed of two thicknesses of cheese or butter cloth stretched on a frame and supported over a vessel. After the liquid stops dripping the pulp may be returned to the digesting-vessel, water added, and again digested with further weak alkali solution. This treatment is repeated until for every 1 lb. of moist bark there

are 4 litres of liquid (1 litre = 1·76 pints, 1·76 × 4 = 7·04) = 7 pints of dye-liquor. This liquor is now very slightly alkaline or acid. If alkaline, acetic acid or vinegar should be added till quite acid and a few pieces of carbonate of lime or marble added in powder; if already acid the acetic acid need not be added, but the limestone should. A gallon of the liquor should dye 1 lb. of wool, but more or less should be added as a lighter or darker tone is desired.

Where the wood of the *Coprosma* is used for producing the dye, owing to the fibrous nature it cannot be forced through a mincing-machine, and must therefore be chopped up into chips on a chopping-block with a small hatchet and then passed through a grit-mill (used for making fowl-grit). This will reduce it to small pieces, which may be treated exactly as the bark was after it had passed through the mincer.

Mordanting the Wool.—A mordant is a substance which is used to fix the dyestuff on the fibre. The fastest colours are usually produced by the use of chromium as a mordant. In practice it is usual to apply this at the rate of from 3 to 4 per cent. of the weight of wool. A 3-per-cent. bichromate-of-potash solution is made with hot water, and a measured amount of the solution containing bichromate equal to 3 per cent. of the wool is poured into an enamelled iron vessel. The solution is diluted with water until there is enough to cover the wool, and the wool, thoroughly wetted with water, is added; the whole is then gradually brought to the boil, and allowed to simmer gently for an hour and a half. The wool is then taken out, rinsed in cold water until the water is no longer coloured yellow, and kept in the dark until required to be put into the dye-bath. If the wool is allowed to be exposed to daylight for any time after mordanting with bichromate it is affected in such a way that it does not take the dye equally.

Dyeing.—The wool is now immersed or "entered" in the dye-bath, which may be a kerosene-tin or cheap tinned or galvanized-iron vessel. It will be found advisable to increase the heat gradually so that the liquor reaches the boil in about an hour, turning the wool frequently. The whole should be boiled for an hour, taking care that the wool is thoroughly immersed in the liquor. Finally remove the wool from the water, wash in cold water, and wring out each time in fresh water until no discoloration of the wash-water is produced, and hang up to dry.

As it will be very difficult for amateurs to arrive at the precise conditions for securing exactly the same tone of colour in two batches of wool dyed at different times, if it is desired that a certain quantity of wool be of one tint it should all be dyed at one time in the same bath

MECHANICAL CULTIVATION.

THE STEAM-TACKLE SYSTEM.

HAVING recently devoted considerable space to the agricultural tractor, we give publicity in the *Journal* to the following remarks (which are not necessarily endorsed in all particulars) by a correspondent, regarding an alternative system of mechanical cultivation less known in this country. In the course of his communication he states,—

I have been somewhat surprised when talking to New Zealand agriculturists to find such ignorance and incredulity as to the capabilities of the double engine system of steam ploughing. Some of the travelled ones remember seeing it at work in England and on the Continent "years and years ago." No doubt they did, but they would see much more of it at work if they travelled through England or the Continent to-day—yes, on the Continent even to-day. It is just another illustration of the foresight and thoroughness of the people of the Central Powers that they have imported from England during the last thirty years thousands of sets of steam-ploughing tackles from John Fowler and Co., of Leeds, the patentees and makers of steam-ploughing machinery on the double engine system. There is no doubt that their ability to provide for their own wants during the years of war and blockade is largely due to their up-to-dateness in mechanical cultivating equipment. It is also on record in the British agricultural journals how much the Government scheme of increased crop-production in the United Kingdom has been assisted by the splendid help rendered by owners of double engine tackle.

I cannot see my way to agree with those who advocate every farmer having his own tractor to help him through with his tillage operations. In the first place, I have not yet seen a reliable tractor; secondly, I do not consider the use of most tractors advisable on heavy lands. Besides the positive damage done to the land by the tractor compressing it, thereby excluding air-circulation, there is an enormous waste of energy through the tractor having to propel itself. This loss is continuous, and varies from 50 per cent. to 60 per cent. of the total power given off by the tractor, leaving only 40 per cent. to 50 per cent. available for the implement; whereas with the double engine tackle the whole of the efficient effort of the engine is available for the implement. Another matter of great importance is that when winding the implement across the field by a steel cable the speed can be very much accelerated, which increases the efficiency of the implement enormously. This has almost to be seen to be believed and appreciated.

No doubt I shall be told that the first cost of a double engine tackle, with its various implements, is too great an outlay for the ordinary farmer. I agree; but my opinion is that the ordinary farmer would be much better off without his "very own" steam-ploughing machinery, just as the ordinary farmer does better to hire a contract threshing-machine to do his work instead of having an expensive threshing plant of his own. The threshing contractor comes along with his own crew of men, does the work expeditiously, and moves on to the next farm as

arranged. From a labour point of view, and also from the business aspect, it is a great boon to the farmer. Such an arrangement for ploughing and preparing the land for a seed-bed I think would be a great help to many farmers.

DOWNY MILDEW OF THE VINE.

A WARNING.

S. F. ANDERSON, Vine and Wine Instructor.

A WRITER in *The Wine and Spirit News and Australian Vigneron* of 25th February last states as follows:—

Australian vinegrowers are faced with a most serious vine-disease, which has caused an industrial calamity in Victoria this year. With the exception of a very few favoured localities the Victorian vintage of 1918 will be non-existent. The extreme virulence of the disease and the unprecedented climatic conditions upset all calculations, and destroyed the crop in a few days—or, rather, almost a question of hours. Nothing at all like it has ever been seen previously in Australia, and for that reason no adequate provision was made in spite of the timely warning given by Mr. de Castella soon after the disease was first discovered, early in 1917. Lecturing in Rutherglen in February, 1917, the Government Viticulturist warned growers that, given favourable climatic conditions, the conidia of the fungus could be broadcasted in countless millions with the rapidity of the smoke from a bush-fire. . . . Many who have studied the disease with care are of the opinion that one preventive spraying applied early would have saved at least 90 per cent. of the Rutherglen crop. An instance of this assertion is now visible in rows of vines which were sprayed early at Burgoyne Brothers' Mount Ophir Vineyard, with the crop intact, while unsprayed vines alongside of them have no crop at all.

This form of mildew is called "downy" mildew, and is the *Plasmopara viticola* of science. Whether it is in the Dominion cannot at present be decided. If it is, there is the danger of it spreading, and therefore a timely warning is required. The two chief troubles of the New Zealand vinegrower are powdery mildew (*Oidium Tuckerii*) and black-spot (*Gloeosporium ampelophagnum*). The latter is controlled by bordeaux applied full strength in the winter, and during summer with the usual summer formula. The winter dressing should always be given, as summer attacks are thereby much more easily controlled, excepting in very unfavourable seasons, when several applications may be necessary. If this treatment is methodically carried out the risk of downy mildew attacking the vines is much lessened. For the ordinary mildew, of course, dry sulphur or atomic sulphur must be used during the growing season.

In order to assist the vinegrower to recognize *Plasmopara viticola* the following description from George Massee's work, "Diseases of Cultivated Plants and Trees," is given :—

Every portion of the plant above ground is attacked, but more especially the foliage, where its presence is first indicated by the appearance of pale yellowish-green patches on the upper surface of the leaf. Corresponding areas on the under-surface soon become covered with a delicate greyish mildew; these patches continue to increase in size, and run into each other, until finally the entire surface is covered with mildew. Soon after this stage has been reached the leaf turns yellow, then brown, dries up, and falls, but not before myriads of spores have been liberated and dispersed. Spraying at intervals with diluted bordeaux mixture until the grapes are set will check the disease. During winter, when the vines are resting, thoroughly drench the plants with solution of sulphate of iron. Remove and burn all diseased leaves.

Comparing the two forms of mildew, the following is a description of common powdery mildew by the same author :—

The mycelium of the fungus forms white or greyish patches on the upper surface of the leaves, young shoots, inflorescence, and fruit. These patches, which are small at first, gradually extend until the entire surface of the organ attacked becomes covered with a white mildew.

DESTROYING CALIFORNIAN THISTLE.

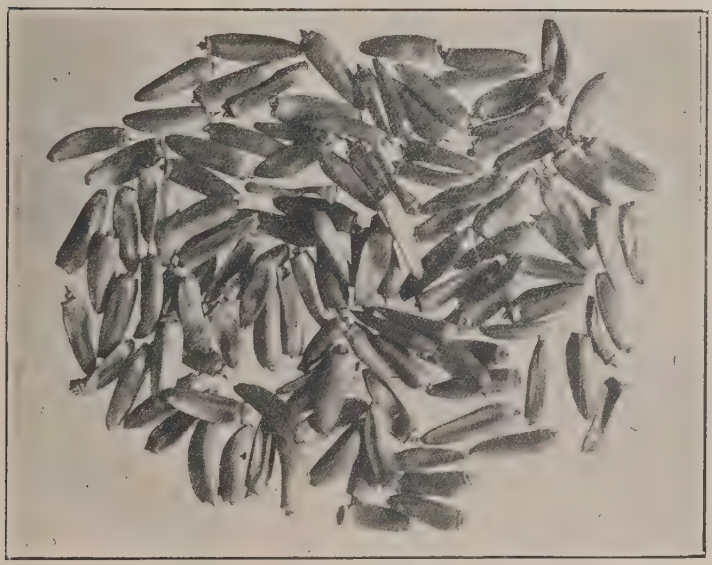
A PARTICULAR method of destroying patches of Californian thistle with straw has been practised by certain farmers in South Canterbury for a number of years past, but does not appear to be so generally known as its merit warrants. Under this system the patch is well covered, in autumn, with straw to a depth of about 1 ft. In spring the thistle comes through the covering in spindly whitish shoots. The straw is then turned with a fork, this operation breaking off the shoots. An alternative and perhaps rather more thorough plan is to pull the shoots with the hand, gloved. Either method can be repeated as necessary. Patches have often been killed out in one year by this system, but if necessary the treatment can be continued for another season. The straw in due course rots and makes good manure for the ground. As with all other farm operations, careful attention must be given to manipulating the thistle patches under treatment. Dumping down the straw and doing little or nothing further is practically waste of time. The principle of the system is not immediate smothering, but inducing a struggling weakly growth which exhausts the plant, the killing process being furthered by the breaking of the shoots. Where straw is not available fern or other material, such as gorse clippings, might be used for the same purpose. The originator of the method described appears to have been Mr. A. Clelland, now resident in Timaru, who completely cleared his farm at Cave of the thistle ten or twelve years ago. It may be added that Mr. Clelland had previously tried to destroy the thistle patches by the application of salt, but with very ill effect on the soil, the land being what is colloquially termed "tarry" limestone country, which sets hard when liberally dosed with salt.

SEED-TESTING NOTES.

E. B. LEVY, Biological Laboratory, Weraroa.

PRESENCE OF CALIFORNIAN THISTLE.

IN seed-testing work during May, Californian thistle (*Cnicus arvensis*) was found present in the following lines of seed analysed: Crested dogstail (four samples), alsike (one sample), timothy (one sample), perennial rye-grass (one sample), Chewings fescue (one sample). One 8½-gram sample of crested dogstail contained 117 seeds, of the thistle,



CALIFORNIAN THISTLE.

Actual seeds picked out of crested dogstail sample of less than ½ oz.
Magnification, 6 diameters. *E. B. Levy, photo.*

equal to approximately 6,250 seeds per pound. This means that if 3 lb. of this crested dogstail was included in a mixture, 18,750 seeds of Californian thistle per acre would be sown, or about four seeds per square yard. The alsike and timothy were imported lines, and the remainder mainly from the South Island. The rye-grass sample appeared as though it had been dressed out of crested dogstail.

MEADOW-FESCUE (FESTUCA PRATENSIS).

The lines in general of this seed received for test during the past three months have been of low germination, the average of twenty-seven samples being 52·26 per cent. (minimum, 4 per cent.; average, 52·26 per cent.; optimum, 95 per cent.). Practically one-third of the samples showed a germination capacity of between 40 and 50 per cent. The great range of variation in the vitality of this seed makes a germination test imperative. Most of the samples contain the seed of bracted plantain (*Plantago aristata*), the presence of which indicates American origin. The purity of the samples is lower than last year, 3 or 4 per cent. of extraneous seeds being common. Evidently the increased price is causing merchants to refrain from recleaning this seed.

CALIFORNIAN THISTLE IN SAMPLE OF CRESTED DOGSTAIL.

Showing relative size of respective seeds. Magnification, 6 diameters.

E. B. Levy, photo.

LOCALLY GROWN TURNIP AND RAPE SEED.

What few samples of New-Zealand-grown turnip and rape seed have come in for test have shown a very high germination capacity, the following being the percentages :—

	Minimum.	Average.	Optimum.
Turnip ..	.. 98	99	100
Rape ..	.. 94	97·6	100

The great viability of locally grown seed is reflected not only in the high final germination but also in the rapidity with which germination occurred, over 90 per cent. of the total germination taking place in two days. Seed sown in boxes has been through the ground a day before similar seed of imported origin.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

THE opportunity afforded by the dormant period of putting the orchard into the best possible working-order preparatory to the coming season is no doubt fully appreciated and availed of by practical fruitgrowers, the majority of whom will be now hard at work in this direction. However, for the benefit of those who lack experience it may be well to again summarize the position. During this period all such work as planting, pruning, spraying, cultivation, drainage, attention to hedges and shelter generally, grafting, and manuring may be attended to. All these matters are essential to the future welfare of the orchard. To what extent, if at all, any one of the various operations takes precedence over the others depends entirely upon local conditions and the age and state of each individual orchard. Apart from planting and renewing trees, which is not usually required in well-established orchards, all the other items play a very important part and depend one upon the other for success.

The order in which the work should be done is also governed by circumstances to some extent, but in the main it should be something on the following lines: Take a mixed orchard in the autumn with all the winter work ahead. Whilst the trees are still casting their foliage, hedges may be cut and trimmed and prunings burned; shelter lopped and otherwise attended to, and preparation made for planting additional shelter if required; drains cleaned out in readiness for the winter rains, and (adequate drainage being a very important point) additional drains laid down if necessary.

Should the orchard-trees be affected with San Jose scale apply lime-sulphur, 1–12 to 1–15, as early as the foliage will allow satisfactory work to be done, and attend to the pruning afterwards. Otherwise the pruning of the stone-fruits may be commenced when ready.

In view of the ravages of brown-rot during the past few seasons, pruning should be done with extra care. Spores of the disease are spread throughout the orchard, and are to be found affecting diseased and dead wood, particularly the stubs of the previous year's fruit. All such sources of affection should be cut away and destroyed. After pruning the stone-fruit area all prunings should be gathered and burned, together with all mummified fruit and other matter likely to harbour the disease.

Plough the land thoroughly, turning under the whole of the surface-soil, fallen foliage, &c., and finish off with the spade what cannot be done with the plough. Work the soil down with the cultivator and harrows in the early spring without reploughing. The alternative to

working the land in this way is ploughing and working down in the spring before the trees break into blossom. The object in either case is to thoroughly turn under all old fruit, foliage, and other rubbish before the resting spores thereon change to their summer form. The danger of relying on early-spring ploughing is, of course, the unreliability of the weather and the impracticability of working some soils when at all wet.

After completing the stone-fruit area attention may be given to pip-fruits. This practically brings us to the present stage. If the work in the orchard has been attended to in its proper order, without interruption, that for the month of July should be mainly confined to the pruning of apples and pears. Some attention may have to be given to the application of fungicides to the early-blooming varieties of plums and apricots, but this work will be generally taken up during the following month. The same applies to the application of oil-sprays. Oil may be applied generally in July, but other than in special cases this work should be deferred till August, always assuming that the necessary labour is available to cope with this as well as all the other work necessary to be done during that month.

PRUNING.

A great deal has been said, and will no doubt continue to be said, for and against the systematic pruning of fruit-trees. However, despite the fact that there are instances where heavy crops of good fruit are year after year being taken from indifferently pruned trees, practically every up-to-date orchardist is satisfied that this system of treating trees does not pay, and that a vast amount of benefit is to be gained by adopting a judicious system of pruning.

There are undoubtedly many advantages to be gained from pruning, apart from regulating the annual crop the tree produces. By this means a tree may be kept under perfect control. Comparatively small trees can be brought to bear very much heavier crops than is the case with unpruned trees of almost twice their size. The smaller tree naturally lends itself to more effectual treatment. Not only can the fruit be more readily thinned and gathered, but spraying is more readily and effectively performed. The maximum of air and light admitted to the well-trained tree, which adds colour and quality to the fruit, also acts against the development of various fungus diseases.

By means of pruning, provided other essential details are properly attended to, the whole character of a tree can be readily changed. Young trees can be made to grow rapidly, while at the same time the permanent branches can be placed practically where required, and a strong, sturdy, well-shaped tree, capable of carrying profitable crops, can be built up in a short time. So also can more or less stunted trees worn out by over-bearing and other forms of neglect be made to take on new growth and life and again become profitable. In either case, however, a very liberal use of the knife is necessary during the winter pruning.

When young trees are planted it is almost impossible to prune them too hard. It is at this stage that most inexperienced planters fail, and the cause of such failure can invariably be traced to the too tender care of their trees in the way of cutting back during the first two or three

years after planting. The wisest course to follow in dealing with young trees is, "When in doubt cut hard." If one does so, and the root cultivation and drainage are good, more or less strong growth is sure to follow. Strong growth invariably provides a selection of suitable permanent branches. Repeat this treatment, moderated or extended as the results suggest, back it up with the removal of misplaced growth during the early summer, and a well-shaped, sturdy tree must soon result.

There are certain underlying principles which form the basis of all pruning. If these are borne in mind the aims and objects can be readily appreciated. These are as follows: (1.) Hard winter pruning encourages strong growth. (2.) Strong growth is required for building up a strong serviceable tree, and in stimulating one affected by continuous bearing or other causes. (3.) Strong growth is opposed to fruit-production, whilst moderately weak growth favours it. (4.) Summer pruning has the reverse effect to winter pruning.

In following the foregoing rules it becomes evident that heavy pruning is necessary during the first two or three years after planting, to encourage strength of wood, whilst summer pruning should be indulged in as little as possible. Some summer work is, of course, advisable, but it should be confined to disbudding or the removal of useless growths, such as are unduly robbing the permanent branches, and should be attended to as far as possible during the early part of the summer. Broken branches resulting from heavy gales or storms may, however, necessitate this work during any part of the growing season.

This form of both winter and summer treatment should be continued in moderation until a tree of the required size and stability is assured. When this stage is in sight the tree will be in a vigorous state, and the object will then be to steady it down as quickly as possible without permanent injury until the ideal state of productivity is reached. There are several means adopted for doing this. If the tree is only moderately vigorous a considerable lightening of the winter pruning, combined with moderate summer pruning, may suffice, or the tree may be lightly pruned in the winter and leaders left unshortened. On the other hand, it may be necessary to apply principle No. 4, reverse the time of pruning altogether, and do practically all the pruning with the exception of the leaders in the summer. In this case the summer pruning should be done later in the season than previously mentioned for young trees, the object being to give the tree a very decided check. To make this effective the pruning should be timed so that the tree will not properly recover from the check before the sap ceases to flow for the season.

Other methods of checking the strong growth of a tree are ring-barking and root-pruning, but these methods should not be adopted except in extreme cases, and not without some knowledge of the possible results.

Apart from the foregoing there is still required a knowledge of application and attention to detail. The former can be acquired by practice, whilst the latter necessitates a detailed study of the particular characteristics of the different varieties of trees being dealt with. But the broader principles apply throughout, and what applies to the whole tree applies to any portion of the tree, and generally to all trees of the class. Take, for instance, the lateral growths of the majority of apple-trees. This class of growth is rendered weak through

its more or less horizontal position, and if left uncut it will invariably bear fruit at an early date, even though the tree as a whole is growing vigorously. But should such growth be cut back, as was the common practice, to two or three buds from the base, growth is stimulated and the fruit-bearing state deferred rather than hastened.

STANDARD FRUIT-CASES.

In last month's notes, dealing with the measurements of the standard cases adopted by the recent Conference of the Fruitgrowers' Federation, the second case for peaches, nectarines, and plums was, through a clerical error, stated as 7 in. by 11¼ in. by 19¾ in., whereas the figures should have been 7 in. by 8 in. by 19¾ in., the same as the third case adopted for pip-fruits.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE month of July should not only see all breeding-pens mated up, but where large numbers of chicks of the heavier breeds are required—such as Orpingtons, Rocks, Wyandottes, &c.—no time should be lost in placing their eggs in the incubator. When it is intended only to bring out a small number of chicks the hatching of the heavy breeds may be delayed until August. In the case of Leghorns and breeds of similar type it is best to hatch these about the end of September.

It is a mistake to leave the mating until just before eggs are required for hatching purposes. The birds should be given an opportunity to settle down and become accustomed to their new surroundings. Especially does this apply to birds taken from a free range and placed in confined quarters. In such cases they will usually fret, and it cannot be expected that eggs containing strong germs will be produced by birds in this condition. Another advantage in early mating is that the eggs can be tested for their fertility before being actually required for reproductive purposes. It sometimes happens that the male bird is unsatisfactory, and that a high percentage of infertile eggs are produced. This may cause the postponement of the hatching-period, probably through the inability to secure a fresh male, or other causes. It is always a good policy to have a spare male at hand as a stand-by.

The necessity of not neglecting any detail that will ensure having the full complement of chicks hatched by the end of September or early in October cannot be too strongly emphasized. It is always better to be a month too early than a month too late. Chickens hatched late are always more or less unsatisfactory, but with the present high cost of food they may easily mean a loss to the poultryman. Of late fresh eggs have ruled at exceptionally high prices, and many poultry-keepers are asking why their fowls are not laying. The answer is a simple one. Either the pullets have been hatched too early and have gone into a moult, or they have been hatched too late and will come into profit only when the egg-market is declining. Of course, even stock brought out at the right time will not lay well (especially in winter) if not fed and housed to the best advantage.

MATING.

Mating birds with a view to increasing egg-production is without doubt the most important part of the poultry-keeper's work, because on the stock produced largely depends the profits to be made from his future flock. Fowls, like any other class of live-stock, can only be improved, or their existing good qualities maintained, by careful selection and breeding from purebred stock. Where haphazard methods of mating are employed the stock is likely to deteriorate or revert to mongrelism. Especially and unfortunately is this the case with poultry. It is therefore imperative that great care and judgment be exercised in chosing for the breeding-pen the best specimens possible.

In the first place only birds possessing a strong constitution and capable of producing healthy vigorous progeny should be used. Birds that are undersized or show the slightest constitutional weakness should be rejected. Do not breed from a freak type of hen merely because she has proved herself a good layer. It should ever be remembered that the best layer is not necessarily the best breeder. The ideal breeding-bird should have an egg-yielding performance, but constitutional vigour, breed-characteristics, and desired size should be happily combined. This is essential for the reason that in accordance with nature's law any weakness in the parents will usually be reproduced in the progeny, and probably in an intensified form. Because a hen has some slight breed-defect it is not a reason why she should be excluded from the breeding-pen. In this case an endeavour should be made to rectify the weakness by using a male which is strong where the female is weak, or *vice versa*. For instance, a pen of hens may have all the desired points looked for in a good breeder with the exception perhaps that they are a bit leggy. The safe course then would be to use a low-set male rather than a leggy one.

Some breeders at the present time attach too much importance to egg-yielding pedigree, and ignore the principle that it is essential to maintain size and breed-type in their flock. Pedigree is all very well in its way, but it should be realized that egg-record is not everything. Notwithstanding the pedigree possessed, birds will be produced which will be unsatisfactory from a breeding-stock viewpoint. There are culls, throw-backs, and wasters in the best strains ever bred. During my visits to poultry plants I have frequently noted weak types being bred from which have come from some noted breeder probably having been sent out as day-old chicks or settings of eggs. Every man is not given the eye for selecting the ideal breeding-bird, even though he may have a fair eye for laying form or be possessed of trap-nest or single-pen records, and if he fails to mate to the best advantage it is possible that the egg-yielding standard, instead of being raised, will decline.

Numerous instances can be cited where breeders have built up a heavy-laying strain merely by breeding from the best layers for several generations, only to find that their work has been thrown away because they have neglected size and constitutional vigour. It should never be forgotten that in breeding operations one character can only be improved at the expense of another. Therefore the greater the egg-yielding power of a bird the greater must be the tax on its reproductive organs and constitutional vigour. Thus, if egg-yielding capacity alone is looked to, other useful qualities must suffer

as a consequence. The aim of the poultryman should be to produce a uniform flock of layers. This can be achieved only by fixing in his mind the type he is striving for, and breeding only from birds of that type. As an argument to prove the laying-type advocated to be wrong, I have recently had freak types pointed out to me as excepti nal layers. This is a weak contention, as although a freak type may be a good layer there is no guarantee that it will produce like. The progeny will probably be of all shapes and sizes, having nothing to distinguish them for productive capacity.

Successful breeders the world over—no matter the class of stock—aim at developing even flocks or herds of the animals they are breeding. Type is the first essential, and uniformity of that type is the next consideration. It is therefore injudicious to attach too much importance to egg-yielding power in the mating of breeding-birds. The ideal bird for the production of layers stands out prominently to the man who has an experienced eye. He is able almost at a glance to choose those that to a great extent will best produce their kind. Especially does this apply if he knows the particular strain he is working with. The eye for form is a natural gift; a man possessing it is not always able to impart to another how his judgment is framed, though his judgment may be unquestionable.

There are, however, outward signs in a bird by which even the beginner, after careful study and observation, should be able to select the strongest birds in a flock. Good health and vigour is usually indicated by a prominent fiery eye, comb and face bright red, close and thick feathering, short shanks set well apart, well-developed crop, and a general active and businesslike appearance. As to egg-producing capacity, this is mostly manifested by an oblong body, wide across the back, a well-developed crop, a deep and full abdomen, and fine texture throughout. Do not forget that the male is more than half the flock. He should be the offspring of a heavy-producing mother, have plenty of "timber" about him, undoubted constitution, and be masculine in every respect. One of the best certificates of health in a male is a glossy, well-kept plumage. Breeding from healthy stock not only means good hatches of strong chicks, but is one of the best safeguards against disease infection. When practical experience of utility poultry is extended the recognition of definite type will become clearly acknowledged. Theory will never alter the matter.

THE APIARY.

E. A. EARP, Apiary Instructor.

SPARE supers that were left on the hives should now be removed where it can be done without unduly disturbing the cluster and the bees confined to the brood-chamber. In the northern parts of the Dominion breeding will start in colonies of normal strength at the latter end of July, and every effort should be made to make the bees snug, so as to promote breeding. Where the bees have taken to the supers entirely the bottom story is the one to be removed. As advised last month, extra mats should be supplied to conserve the heat of the hive.

During the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies are by this means reduced to the verge of starvation by the spring. It is only the work of a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble contract the entrances.

A periodic examination should be made of all extracting-combs stored in the honey-house, for the purpose of seeing that they are not attacked by moths. Where the combs have been attacked they should be fumigated. To fumigate, place the combs in supers piled one above the other, and put a saucer full of carbon bisulphide on the top. The fumes, being heavier than air, will sink slowly to the bottom, destroying all moths and eggs with which they come in contact. Care should be taken not to inhale any of the fumes, as they are poisonous. The gas being highly inflammable, it should not be brought into contact with a naked light.

As advised last month, do not delay getting together supplies of hives and foundation. All orders for requirements should be placed with the dealers not later than July. The difficulty of transport is making itself felt, and the prudent man will have his orders in well ahead of time.

MOVING BEES.

This is the one and only season during which beekeepers should attempt any wholesale shifting of their bees. The bees will be in as nearly dormant a condition as it is possible to find them in our mild climate, and they should be numerically weaker than at any other time of the year. The moving of bees either long or short distances has in each case peculiar difficulties to be overcome. In the former case there is the question of ventilation to be thoroughly considered, and also the matter of making the inside of the hive as immovable as possible. The vibration set up by any mode of transport tends to disturb the cluster, thereby exciting the bees and thus raising the temperature of the hive. When this takes place the bees are in danger of suffocation and the brood of being scalded. The use of wire screens will to a large extent prevent the occurrence of these troubles. Where possible all heavy combs should be removed from the hives, leaving only sufficient honey to keep the bees from starvation during their journey. The vacant spaces should be filled with empty combs, and the frames made as secure as possible by inserting wedges between the tops of the end frames and the walls of the hives. This should prevent the frames from rocking during transit. The bottom-board should be secured to the hive-body by means of crate-staples, using about six to each hive and driving one end of the staple into the hive-body and the other into the bottom-board. The wire screens—made by using narrow laths nailed together to form a frame of the same dimensions as the top of the hive-body and covered with wire-cloth—should be securely fastened to the top of the hive-body, and more wire-cloth tacked over the entrance to the hive. This last operation should be carried out at night when all the bees are indoors.

The hives should now be quite ready for a long journey. The roofs will, of course, not be needed. In placing the hives in a cart or

truck they should be arranged so that ventilation through the wire screens will not be interfered with. If stacked exactly one on top of another the bottom ones will be prevented from obtaining the requisite amount of air. Wooden battens should be placed between each two tiers. Motor transport is, of course, the ideal method of dealing with bees, and where possible the beekeeper should adopt this means.

In moving bees a short distance the difficulty is of quite another nature. Sufficient ventilation is easily obtained by means of wire-cloth tacked over the entrance, and with the bottom-boards and covers firmly secured to the hive-body by means of staples the hives should carry without any trouble. Unless, however, the beekeeper chooses his time well he is apt to lose many of his field-bees when moving the hives a short distance. The field-bees know every landmark within a fair distance of their hives, and in the summer their knowledge must extend over several miles of country. With the approach of shorter days their flight becomes correspondingly shorter, until in the depth of winter it resolves itself into a mere search for exercise. Consequently, when a spell of bad weather arrives and the bees are confined to the hives for days at a time, their familiarity with their surroundings must lessen. Therefore if the beekeeper wants to move the bees a short distance with a minimum of loss he should choose a time when there is a prospect of several wet, cold days arriving. By the time the bees are able to take a flight again they will have lost all interest in the old landmarks and be just as ready to adopt the new site as the old. By removing bees a short distance during a spell of fine weather innumerable field-bees will be lost through their tendency to return to the old site on leaving the hive. It may be mentioned that a slanting board, if placed in front of the entrance of the hive, will make the bees take more notice of the change in their surroundings than they otherwise would.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

VINEHOUSE WORK.

PRUNING of vines in the cool-house should now be approaching completion. The many different methods advocated and applied to orchard-trees need not confuse the pruner of vines under glass. He has generally but one stem to each vine, and should there be more rods to a vine they are all pruned in the same manner. The fruit of the vine comes on a new shoot grown from a bud formed the year before. These shoots are fairly large and prominent, and are to be found at the base of every leaf. The shoot that has borne a bunch of grapes is at this season hard brown wood, and the place from which it started to grow last year can be seen as where it was cut back to. It has now to be cut back again to get another new shoot, but not to quite the same place. Just where the previous cut was made several prominent buds are to be seen. The pruning now required is to cut off the hard brown wood made last year just above one or two of these

buds. One is sufficient to leave, but for amateur work we will say two. In the spring both will grow, and the most suitable can be kept and the other rubbed off. Each shoot right and left on the stem or rod of the vine has to be pruned in this manner, leaving the rod a bare stem from top to bottom. The end or point is treated in the same manner as the side shoots. For any further explanation see Bulletin No. 40, "Cultivation of the Vine under Glass."

VINEYARD AND CELLAR.

Methods of pruning outdoor vines are many, but those practised in New Zealand are confined principally to two—the double Guyot and long-pruning of the American class of vine. All the European vines are pruned double Guyot method for the wine-bearing grapes and trained on wires. Description of the pruning of outdoor vines without diagrams or practical demonstration generally confuses beginners, and any such may be referred to the illustrated articles "Outdoor Culture of the Grape-vine in New Zealand," published in the *Journal* from February to May, 1917.

Present labour difficulties cause one to hesitate to remind the vigneron of all that ought to be and can be done in the vineyard. It is suggested, however, that the following should receive attention: (1) Pruning, as essential; (2) spraying with bordeaux, this being the more necessary on account of another form of mildew of a very virulent type—"downy" mildew or *Plasmopara viticola*—having made its appearance in Australia, as described elsewhere in this issue; (3) ploughing the vineyard.

Casks containing new wines should be carefully filled up. Bung-cloths should be renewed, and those taken off carefully washed in hot water. Fine the sufficiently matured older wines for sale. Bottle fit wine in good weather. Rack new wines as they clear.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

With July the busy time in a vegetable-garden begins, that month being really the beginning of spring so far as concerns gardening operations. Cabbages, cauliflowers, and lettuces—from seed sown at the end of March or the beginning of April—should now be planted out. Older plants have a strong tendency to bolt to flower, and they should not be planted.

In respect to cabbages, the provisions made should depend on the purpose for which they are grown. Spring cabbages after the heads are cut sprout with great freedom. If the sprouts are thinned so as to leave three, these will develop into well-hearted heads weighing from 2 lb. to 4 lb. each. A bed so treated will produce heads till near midsummer. In a private garden this sprouting habit saves a planting. The sprouts are always milder in flavour than the first head, a fact

that should not be lost sight of. The sprouts, however, are not suitable for market purposes, so the market-gardener must plant an additional bed of a later, therefore larger, kind to succeed the spring variety, either at the same time or quickly following the first planting, and he will draw the stumps as soon as the heads are cut.

Cauliflowers of two kinds should be set out at once. An early type, such as Snowball, will come into cut before October is passed and carry on till the end of the year. A large kind, like Early Erfurt, Metropole, or Autumn Giant, put out at the same time, will begin to head about the end of the year when the earlies are about over. Lettuces should be planted in maximum quantity in proportion to needs. This planting produces what are probably the best heads of the year and at a time when they are most appreciated.

Onions of giant kinds should be planted. Small kinds may be also put in, and in some circumstances it is good policy to do so. The giant kinds should be planted as a matter of course, as they cannot be grown to full size from spring sowing. It is not wise to leave them to grow where sown; transplanting is necessary to prevent them going to seed.

Peas are sown as the beginning of the season's routine, and hereafter are to be sown at intervals of two weeks. The first sowing should consist of two types, a dwarf for first use and a taller kind to succeed it. The tall kind is longer coming in than the dwarf, which is the reason for sowing both together. Drills for peas should be drawn about 4 in. deep. A little soot sprinkled over the seed before covering with soil will materially improve growth, and protect the seed from slugs, wireworms, and mice. Birds are in some places very destructive to peas, eating them off as soon as they show above ground. In the *Gardeners' Chronicle* of a recent date appears the statement that a line of scarlet worsted stretched along the rows will save them. The colour (scarlet) is said to be important. I know that if the rows are provided with sticks, however short they may be, birds will not touch the peas. Spraying with quassia-water will also save them. A little lime added serves as an indication when another application is required. Broad beans should be sown, unless this has been recently done, in which case it is not necessary. The next sowing should be made in October.

If the soil is in a fit state, onions for the main crop and carrots for early supply should be sown. The seeds of both these are rather slow to germinate, they usually show through in three weeks—a little longer or shorter time according to circumstances. It is on this account important not to sow unless the soil is in good working state and drainage good. Unless these conditions are present early sowing would be likely to result in failure, and it would be best to wait for warmer weather, but early sowing is decidedly preferable where conditions are suitable.

The soil in which onions are to be sown or planted should be rich. Stable manure suits them well, and if there is plenty of this artificial fertilizers can be dispensed with, except nitrate of soda, the use of which, as well as that of other fertilizers, will be described in the July *Journal*. The surface of the soil should be brought to a fine tilth and made firm by rolling or treading. A liberal dressing of wood-ashes

is beneficial, provided they have been kept dry, as they help to keep the soil open and supply potash. If there is no manure available, or it is insufficient, give a mixture of superphosphate and bonedust, 2 oz. of each per square yard, or in place of super give basic slag, 4 oz. instead of 2 oz.

Carrots should be sown in ground that was well manured for a previous crop. Stable manure should not be applied, as it causes the carrots to crack, particularly if there is much rain to render the manure soluble and so available to the roots in excess of their requirements. Wet weather alone will not cause cracking.

Shallots and garlic should be planted at once. Plant in rows 12 in. apart, the bulbs 9 in. or 10 in. apart in the rows. No drill is required; merely press the bulbs into the surface until the bulb is nearly, not quite, buried. Garlic is seldom used in this country except for making sauces, so requirements are small, but shallots should be much more extensively grown than they are. In many ways they can be used in place of onions, and the smallness of the bulbs prevents waste. As a pickle they are altogether superior to onions. Their culture is quite simple, they give little trouble and practically never fail.

Parsnips may be sown where they are required for use during the summer months, or in very dry places where it is difficult to secure germination later. In an ordinary way they are not required in private gardens till late autumn, and should not be sown now. Sow a turnip-rooted variety of red beet for early use. Also sow parsley, and plant herbs of other kinds, such as thyme, mint, sage, marjoram, and savoury.

Lettuce and cabbage seed should be sown. Cauliflower may also be sown, but it will not be necessary in a private garden where planting as advised has been done.

Seakale is not suitable for cultivation in a small private garden, but should be extensively grown where a gardener is employed and where stable manure is available. The heads can be forced for use at any time during winter, from the time when the leaves die in late autumn until they start again in spring. Of course, a clump can be forced only once each season; therefore to keep up a supply a number of clumps are required. The clumps are each covered with a kerosene-case from which the top and bottom have been removed. The top boards are to be placed loosely as a cover before putting on the manure. The manure should contain a fair quantity of straw, and be well shaken out and turned several times so as to secure even fermentation. The boxes are to be covered with manure about 18 in. deep all round and over the top of the box. The heads should be ready in about fourteen days after covering. When cutting the heads take them with about half an inch of the solid crown, so that a head may remain whole, not in separate stalks. Before placing the box strew some quicklime and soot round the stool to drive away wireworms and woodlice and kill slugs.

Rhubarb of the summer variety should be planted. Rich soil is essential; it is quite useless to plant rhubarb in poor soil or in very dry situations unless the soil is well supplied with humus. Plant divisions with one or two good crowns, in rows 3 ft. apart from centre

to centre of the crowns and 30 in. from centre to centre in the rows. No produce should be taken from a bed during the first season.

In most parts of the Dominion there is now no need to force rhubarb, the evergreen or winter varieties introduced in recent years being available for use during winter. But I understand these varieties do not flourish so well in the colder districts. In any case forced rhubarb is a distinct article, and well worth while for those who are able to supply the labour and have the manure for forcing. For forcing the summer varieties are necessary, and, like seakale, the plant should be forced in batches. In all respects the operation is the same as for seakale, and the state of the weather does not affect forcing. In England I have had a hand in forcing when snow had to be cleared from the bed before placing the manure. In older countries nowadays forcing is generally done in heated glasshouses, the crowns being lifted early in winter and stored in cellars, where they remain in a dormant state, and are taken in batches to the house for forcing. The stalks of forced rhubarb are extremely tender and delicate in appearance, and are brightly coloured in various shades of crimson, so that forced rhubarb constitutes a delicate and attractive dish however it may be served. In good gardens at Home rhubarb is not used during the summer months, its only use being for forcing.

OLIVER'S PRIDE BEAN.

At top on right are two ordinary runner beans.

RUNNER BEAN, "OLIVER'S PRIDE."

The photograph shows a new variety of runner bean grown by Mr. S. Perrett, of Ranfurly Road, Epsom, Auckland. It is interesting to note that this bean, which is a hybrid of Mr. Perrett's own raising, differs from any known variety. In texture the bean is remarkably tender, being practically stringless, even when apparently too old for use. It cooks as tender as a young marrow, and in flavour is very mild, the slight rankness usually noticed in beans of this class being absent. The beans portrayed were gathered in the middle of May, and therefore do not fairly represent the type. At the proper season the beans grow to 15 in. in length. Mr. Perrett is to be commended for the perseverance and intelligence he has brought to bear on this useful and interesting work.

ANSWERS TO CORRESPONDENTS.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HORSE WITH CRACKED HOOF.

"SORE HOOF," Brydone :—

Kindly inform me in regard to the best means of curing a hack suffering from cracked hoof. The outer shell of the hoof is split from bottom to top, and the horse shows fairly severe lameness at times. On both front hoofs there appear several minor cracks, some of which do not reach either top or bottom of hoof. I have rasped them once or twice and continually applied Stockholm tar. Should I keep him shod ?

The Live-stock Division :—

Sand-cracks may be superficial or deep. The animal should be kept shod, but without seeing him we cannot say if there is any chance of a cure. If he is a valuable animal we would advise you to call in a veterinary surgeon. The general treatment adopted in cases of deep sand-cracks is to apply a Vachette clasp to hold the sides of the crack in close proximity, this preventing dirt from getting in and helping to prevent upward extension. Blistering the coronary band is also resorted to as stimulating the growth of the hoof. The walls of the hoof should be kept soft, but you may be applying the Stockholm tar too often, thus doing harm. Equal parts of tar and grease once a week will be sufficiently often for this purpose.

SOWING PASPALUM.

B. H. STACK, Taikorea :—

Kindly inform me as to the best methods of sowing paspalum-seed in sandy soils. Should I sow deep or shallow, and in dry or wet weather ?

The Fields Division :—

The ease with which paspalum germinates when surface-sown, provided the weather is warm, indicates that there is no need to cover the seed at all deeply. When in a general mixture in the proportion of about 2 lb. per acre the seed can be drilled, but if sown in greater amount hand broadcasting is necessary, as the seed will not run properly. It does not appear to matter whether paspalum is sown in dry or wet weather. The seed is capable of remaining many months in the ground without injury, and germinates whenever conditions are favourable. Thus, much autumn-sown paspalum remains in the ground till the following spring. On sandy soil, such as that between Foxton and Carnarvon, we should be inclined to brush-harrow the ground after seeding, and then roll. Quite good results with paspalum have been secured on the sandy soils of your district by surface-sowing without any preliminary cultivation at all. When this is done we should advise sowing either in the early autumn or in the early spring.

STORAGE OF KUMARAS.

V. P., Devonport :—

I find that kumaras do not keep well with me. Having a nice crop this season I shall be glad if you will inform me as to the best way to store them, so that they will last about four or five months.

The Horticulture Division :—

The following extract from an article by Mr. W. C. Berridge in the *Journal* for October, 1913, may be quoted : "Many methods have been tried for storing kumaras, such as packing in dry sand, putting in clamps, storing in sheds, &c., but experience teaches that storing in *ruas*, as the Maoris call their underground pits, is the most successful. If properly handled the potatoes can be kept in this manner until the next crop is ready to dig. The kumaras must be dried thoroughly, and the pits opened and ventilated every fine day until the sweating-period is over. This generally takes about a month, and even afterwards the pits should be ventilated occasionally. The tubers should be kept from contact with the bottom and sides of the pit by a layer of dry fern." A *rua* is formed by making an excavation in the face of a bank. After the tubers are placed in the *rua* the mouth is closed by a layer of bracken-fern covered with soil.

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LAMPAS OF HORSE.

A. D. F., Ruawai :—

I have a draught mare much troubled with lampas. Would you kindly tell me what I may do to relieve this, as the lampas are now on a level with the teeth. The mare is rising six years old.

The Live-stock Division :—

Lampas is supposed to be a very common trouble, but 90 per cent. of such cases are due to other causes, such as teething or irregularities of the teeth, injury to the lining membrane of the mouth, &c. If the animal has lampas, all that requires to be done is to scarify the bars of the mouth, which are above the level of the teeth, with a sharp knife. Burning them out with a hot iron, as is sometimes done, is gross cruelty, and action can be taken against any one doing this.

FACIAL ECZEMA IN SHEEP.

"READER," Okaiawa :—

I am running a number of lambs on swedes with a good run off to grass. A few days after being put on turnips about fifty were noticed with very swollen lips and noses, which in the course of a day or two turned to a hard scab. They were at once separated from the balance of the flock, but on looking over the others to-day I notice fully 30 per cent. show signs of developing the same trouble. I should be greatly obliged if you would suggest a cure for the affected sheep, and also advise whether I can do anything to prevent the remainder getting the disease.

The Live-stock Division :—

What you describe is commonly known as facial eczema, and our experience has been that animals with fatty livers having access to a grass run where there is ergot upon the grass or ground are the most susceptible. The treatment to adopt is to yard up the affected animals and give each 1 oz. of Epsom salts dissolved in water, and add to this 5 grains of calomel; then liberally dress affected parts with sulphur ointment—one part finely ground sulphur mixed with eight parts of vaseline. Keep them where they can get shelter from the sun for a few days, and change the feeding-ground for a short time if you can. The trouble is not infectious.

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SUGAR-BEETS FOR COWS.

J. H., Dargaville :—

I have grown a quantity of sugar-beet with the intention of feeding to milking-cows during the winter. Do you recommend it? Would you leave the beet in the ground and pull as required, or pull and store under cover?

The Fields Division :—

Sugar-beets are good succulent feed for milking-cows. They should, of course, be fed with an allowance of hay or other dry fodder. There is no need to store the beets under cover in your district, but they should be taken up a month before they are required for use.

MANAGEMENT OF HOLLY AND ELEAGNUS HEDGES.

J. FREDRIC, Greatford :—

Please advise in regard to the best time to cut young holly hedges, and how to get rid of black sooty scale on same; also the best time to prune *Eleagnus japonica*, and how to get it to grow thick at the bottom.

The Horticulture Division :—

Holly hedges may be cut at any time of the year, but the best is no doubt near the end of winter, just before spring growth begins. Your young hedge may not require much cutting. The holly does not benefit by hard cutting while it is young. The sooty appearance is caused by a fungus growing on honey-dew excreted by a scale insect. Spray with lime-sulphur solution, 1 in 35, or one of the proprietary insecticides.

Eleagnus japonica may be cut at any time when ragged growth needs suppression. A close bottom is obtained by cutting well down at the start. Some of the young long growths that come in a convenient position from opposite directions should be looped together. The shoots are tough and will remain where they are tied. A hedge so formed becomes very dense, strong, and impenetrable.

RYE-CORN FOR STRAW.

T. H. RUTHERFURD, Masterton :—

Will you please state where I can buy rye-corn seed, and should it be sown at the same rate per acre as, say, oats? Also, what is the ruling price to-day per bushel. My object in sowing is mainly to obtain straw for scratching-material for fowls. Further, I should imagine that the straw, being of a tough nature, would be more durable than wheat-straw. What month should rye-corn be sown?

The Fields Division :—

Rye-corn may be purchased from any seed-merchant. The present price is about 8s. per bushel. As you may not be able to graze it back, defer sowing until the beginning of August, and if possible use the Emerald variety. Two bushels of seed per acre will give you a good stand. Rye-straw should be very suitable for your purpose.

HORSES WITH SUPPOSED RINGWORM.

H. F. WICKHAM, Pongakawa :—

I have been greatly troubled lately in connection with two of my young horses, which have come out in scabs over the back and hind quarters. Most of these scabs get about the size of a small marble and then fall off, leaving a sore. I shall be very glad if you will advise me what to do for the best.

The Live-stock Division :—

From the description you give the case looks like ringworm, and if this is so it is contagious. We should advise you to thoroughly wash the animals with strong soapy water and a little washing-soda, and when dry paint the scabs and a little beyond with tincture of iodine.

GRUB-INFESTED LAWN.

C. G. WILSON, Kawhatau :—

My lawn is very badly infested with the grub, and I should be glad of your advice in regard to the eradication of same.

The Horticulture Division :—

There is no really effectual method for getting rid of these grubs. It is a problem that has so far baffled the world. A comparatively new compound known as "Vaporite" has given the best results so far, but it has not been extensively

tested here, and may be more effectual than the trials made have shown. We would advise you to try it; the lawn to be afterwards well rolled, then top-dressed with an inch or so of fine soil, and seeded with *Agrostis stolonifera*, a grass that makes a capital lawn and is not much affected by the grass-grub.

WORKING OVER CITRUS TREES.

F. O. C., Auckland :—

I have a few young orange-trees about four years old which I should like to replace with lemons. Instead of digging the trees out and planting young lemons, could I graft lemon-scions on to these trees? If so, would you kindly state the procedure?

The Horticulture Division :—

Orange-trees can be worked over with lemon-wood by grafting, but it is a method rarely practised. Budding is the better way and is more easily effected. The usual method is to cut the top over so as to secure young growth. The buds are inserted in the new wood. There are several ways of budding citrus trees, and the buds may be put on in spring or in January. The latter month would be preferable for an inexperienced operator. The bud taken must be fully developed. Insert the blade of a sharp knife $\frac{1}{4}$ in. below the bud. Carry the knife up under the bud so as to take a very thin slice of wood with the bud, and bring the knife out $\frac{3}{4}$ in. above the bud. Make a T-shaped incision through the bark of the stock. Push the shield of wood holding the bud down to the bottom of the incision in the stock, cut off the top of the shield so that it will fall into the incision, the top of the shield meeting the bark in the crosscut. The bark of the incision must be firmly bound, leaving the bud exposed. Waxed cloth is preferred to raphia for binding on citrus trees. The leaf against the bud is to be cut off, leaving about $\frac{1}{4}$ in. of the foot-stalk. This is done before the bud is inserted. In about two weeks the binding should be loosened. The stock above the bud must not be cut off till the following spring. To ensure success, if inexperienced, expert assistance should be sought.

BLUESTONE FOR WORMS IN SHEEP.

"Wairoa," Ruapapa :—

Is 1 lb. of bluestone dissolved in 9 gallons of water a sure remedy for expelling worms in lambs if given in 2 oz. doses, and 4 oz. doses for grown sheep?

The Live-stock Division :—

Bluestone has been used for the purpose mentioned, and some stockowners strongly recommend it. Experiments show that it does good, but worms have still been found when the animal has been slaughtered a few days after. As to administration of the cure, the proportions you mention are safe enough to give it a trial. Some advocate the addition of mustard, and in India this has been largely adopted in conjunction with bluestone. The doses for sheep are: bluestone, 16–18 grains; mustard, up to 1 dram.

COW WITH SWOLLEN LEGS.

"Inquirer," Te Kawa :—

I have a cow which is very lame. Her legs are swollen down near the hoof, just like a horse with wind-galls, and are spongy to the touch. Between the hoof-clefts is very tender, but there is no sign of foot-rot. Advice would oblige.

The Live-stock Division :—

The condition of the legs would point to weak circulation. Apply a stimulating liniment, well rubbed in once a week, and give the animal an extra bit of hard feed and a salt lick.

CONTROL OF GRAIN-WEEVIL.

"POULTRY-KEEPER," Howick:—

Kindly advise the best way to check and eradicate weevils infesting sacks of wheat, feed-bins, &c. I should also be glad to learn whether weevils will attack barley.

The Biologist:—

Weevil is liable to attack any of the cereals, and is often extremely destructive to barley grain. The best method of control is fumigation, either with carbon bisulphide or hydrocyanic-acid gas, but both methods are generally impracticable owing to the stores where the grain is held not being capable of being made airtight. I consider that for poultry-keepers the best method of dealing with weevil is to have only a small number of sacks stored on the premises at any one time, and to store them with as much air-space between the sacks as possible, so as to secure as much ventilation as practicable. Under such circumstances weevil develops slowly. When the weevil is extremely bad no more feed should be stored until the stock is exhausted, and then the whole store should be sprayed with kerol (or similar preparation), using it double strength. Two applications should be given, and then any fresh sacks brought in should be very loosely stacked, and moved about, say, every two months. When this is done the weevil will be found to be kept well in check. The hot-air system of treating infested grain (now being employed in Australia) requires a more or less costly plant. Inquiries are being made into this method.

CERTIFICATE-OF-RECORD COWS.

TULIP.

A member of the Ruakura Milking Shorthorn herd. C.O.R., in Mature Class, 12,226·70 lb. milk, 393·77 lb. butter-fat.

BONUS FOR THE PRODUCTION OF PHOSPHATE.

A BONUS is offered by the New Zealand Government for the discovery and working within the Dominion, including the Cook Islands, of a deposit or deposits of marketable phosphate, including guano—the amount being £1,000 if on land on which the Crown is entitled to such deposits, or £500 if on other land.

The following are the conditions under which the bonus is offered :—

1. That no fertilizer containing material from the deposit, or from any deposit in the neighbourhood, has been placed upon the market previous to the date hereof.

2. That the raw material is reasonably accessible and can be worked at a profit.

3. That a committee to be appointed by the Minister of Agriculture to examine the deposit is satisfied that there is sufficient to warrant payment of the bonus ; provided that if a small deposit is discovered a proportion of the bonus offered will be paid on and in accordance with the recommendation of the committee.

4. That the fertilizer made from the phosphate can be disposed of at a price which will allow of its being remuneratively used for agricultural purposes.

5. That the composition of the phosphate averages not less than 50 per cent. of phosphate of lime (tricalcic phosphate) ; provided, however, that should a phosphate of a lower average composition be discovered the committee may recommend that a portion of the bonus be granted.

6. That the bonus shall only be paid to the first claimant who satisfies the above conditions.

The terms of payment shall be—

One-fifth on the committee reporting favourably on the discovery ;

One-fifth on delivery of the first 200 tons to purchasers ;

The remaining three-fifths by equal payments on delivery of each additional 150 tons to purchasers.

Applications, addressed to the Secretary of Agriculture, Industries, and Commerce, Wellington, will be received up to and including the 31st day of March, 1919.

Specimens of phosphate rock may be seen at the office of any of this Department's Fields Inspectors, and a leaflet descriptive of the phosphate, and showing how it may be roughly tested, may be obtained on application to these officers.

Wheat and Oats Threshings.—According to a statement issued by the Government Statistician, returns of actual threshings throughout the Dominion received up to 15th May from threshing-mill owners show that till then 4,435,365 bushels of wheat and 3,079,118 bushels of oats had been threshed out. The Dominion average yield per acre in cases where particulars of areas were furnished works out at 25·11 bushels for wheat and 33·02 bushels for oats. On these threshings, in wheat Canterbury averaged 25·10 bushels, Otago 26·46 bushels, Southland 26·56 bushels, Marlborough 18·36 bushels, and Wellington 20·22 bushels. In oats Canterbury averaged 28·44 bushels, Otago 36·33 bushels, Southland 43·41 bushels, Marlborough 29·45 bushels, Hawke's Bay 33·40 bushels, and Wellington 31·53 bushels.

Meat-freezing Works.—With reference to the list of meat-freezing works in New Zealand published in last month's *Journal*, through a clerical error the cold-storage capacity of the works of the Auckland Farmers' Freezing Company was understated. The correct figures, in 60 lb. carcases, are: Southdown, 172,000; Horotiu, 180,000. This is the present capacity; the company proposes to increase its storage accommodation at both works in the near future.